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MUNICIPAL ENGINEERING

VOLUME XXXIV. MAY, NINETEEN HUNDRED EIGHT. NUMBER FIVE.

ELECTIVE TOWN MEETINGS AS A FORM OF MUNICIPAL GOVERNMENT.

By Alfred D. Chandler, Brookline, Mass.

In 1906 occurred two notable events in New England municipal history: One, the city of Newport's second reversion to the town meeting system of government by the people, after half a century of trials with city charters. The other, the town of Westfield's emphatic rejection of its new city charter, and its retention of the town meeting. Westfield is one of Massachusetts' largest towns, having a population in 1905 of 13,611.

Galveston, Texas, stricken in 1900 with an appalling disaster by storm and flood, dismissed its partisan rulers, who, under the ordinary American city charter, were unequal to the occasion; and, like a corporation needing temporary aid at a receiver's hands, Galveston, in 1901, put its affairs in the full control of a commission of five able and experienced men, who are rebuilding that city and have resored its credit.

If under extreme conditions—as in Galveston's case—but for temporary exigencies only, municipal gvoernment by a commission with full power is advisable, yet for permanency it would not only weaken but it would subvert representative democracy in America, especially in New England.

In the South and West there is no general system of local corporations corresponding to our New England towns. In the South county administration prevails. In the West county and town features are combined. The attempt of northern men to introduce the northen town in the South failed, for the underlying conditions were unfavorable.

Iowa has developed a commission plan for cities with a population of 25,000 or over. Des Moines, the largest city in that state, has adopted it. Iowa was never a slave state; but it copies the "Pennsylvania plan" of county authority, which in New England is almost ignored in local administration. The outcome of Des Moines' new charter is hypothetical. That charter did not go into effect until March, 1908.

The Iowa city commission charter (Section 7) puts "all executive, legislative and judicial powers and duties" of the city into the hands of five men. How is this to be reconciled with the familiar practical truth recognized by the constitution of the United States, embodied in many state constitutions, and expressed in Iowa as follows:

"The powers of the government of Iowa shall be divided into three separate departments, the legislative, the executive and the judicial; and no person charged with the exercise of powers properly belonging to one of these departments shall exercise any function appertaining to either of the others." (Constitution of Iowa, Art. III.)

The true meaning of this maxim is that the whole power of one department should not be exercised by the same hands which possess the whole power of either of the other departments; and that such exercise of the whole would subvert the principles of a free constitution.

The Iowa city commission charter puts "all" these powers, as locally administered, into the hands of five men. That may not conflict with Iowa's constitution, as the government of a city in Iowa is not the "government of Iowa;" yet it does conflict with the settled principle, which is broad enough to apply to a municipality as well as to a state, and is so applied in the New England town meeting system, and it comes within the purview of what James Madison said in the Federalist:

"The accumulation of all powers, legislative, executive, and judiciary, in the same hands, whether of one, a few, or many, and whether hereditary, self-ap-

pointed, or elective, may justly be pronounced the very definition of tyranny."

And of what Mr. Justice Story said:

"Whenever these departments are all vested in one person or body of men, the government is in fact a despotism, by whatever name it may be called, whether a monarchy, or an aristocracy, or a democracy."

The principle of the separation of powers, at least of the appropriating and spending powers, can hardly be overrated for our large modern towns and cities. The axiom is comprehensive. It is not limited to the departments of government as defined in the national or any state constitution, but it applies with equal, even greater force at times, to departments of like kind in municipal administration. In the New England town meeting system it is fundamental.

Occasional relief from commission errors, by the initiative, referendum and recall as under the Iowa City Commission Act, gives no adequate assurance of exemption from the recurring hazards of vicarious centralized control over "all executive, legislative and judicial powers and duties." Such a control impairs civic spirit. It tends to an avoidance of public duties. It ignores the rule of successful administration that prevention is better than palliation; that co-operative vigilance is more effective than drastic correction. There is no royal road to municipal success by trying through legislation to minimize the anticipative obligations of the people. If exceptions occur in cases of catastrophe, physical or financial, demanding heroic treatment, an oligarchic remedy should be but temporary, and be designed to restore local self-government to a normal course as soon as practicable.

It has been said that the New England town meeting system of local self-government, admittedly the best, separating as it does the local legislative from the local executive departments, can not be successfully adapted to large municipalities. Modern legislation and experience refute that error. Municipalities whether large in population or large in fiscal operations are now well governed under the town meeting system, which permits of indefinite extension, both to towns and to cities.

In the larger towns of New England the town meetings are of necessity restricted in attendance for deliberations, because no ordinary hall would hold all the voters. But experience proves that town meetings limited in size are adequate as a rule. Yet to maintain the system wisely, limited meetings of a fixed number of elected members should be substituted for possibly unwieldy or "packed" meetings. An elective town meeting, or "Representative Council" of 195 members, is what the city of Newport has adopted. In this way the system is preserved, simplified, dignified and strengthened, and it may be applied to any municipality. It is immaterial, saving for sentiment, whether the chief executive municipal board is called "Selectmen" or "Mayor and Aldermen." The best number for an elective town meeting may be a polemical rather than a practical question, varying with local coonditions. The average attendance at the Brookline town meetings for purposes of deliberation, is between 100 and 300. This number, if not the best, has been adequate.

There can be no better form of local government; none more in harmony with the true spirit of American representative democracy. It secures six essentials for local self-government:

1. The abolition of politics.
2. The separation of the appropriating and spending powers.
3. Complete publicity.
4. A referendum.
5. Popular control, under wise leadership.
6. An alert and sustained civic spirit.

A convenience in the town meeting system over the usual city council method appears in the very few town meetings during the year, as compared with the frequency of city council meetings. The ratio is about as 1 to 10 in favor of town meetings.

A STREET CLEANING AUTOMOBILE.

By a Berlin Correspondent.

A unique vehicle passing through the streets of the German capital has lately been the object of much attention both on the part of engineers and of the general public. This is the street-cleaning electromobile represented in the accompanying photograph, which is an electrically propelled combined sprinkling and cleaning cart, rinsing and sprinkling the pavement while removing from the latter any dirt and dust, in order immediately afterwards to dry the street, so as to warrant desirable safety of traffic. It may be said that these features are appreciated, especially in a city which, like Berlin, comprises so many asphalted streets, on which the ordi-

nary sprinkling would involve too much danger to the passing vehicles. The main sanitary advantage of the new system of street cleaning is that no dust is raised, while the combination of so many functions in a single machine obviously represents a not inconsiderable advantage from the economical point of view, sprinkling cars, street sweepers and scrubbers being done away with. The water consumption of this combined machine is considerably lower than in the case of the ordinary method, being only about a litre per square meter of asphalted road surface, which amount is fully utilized by the machine, so as to allow no drop to go to waste.

A GERMAN ELECTROMOBILE STREET CLEANER.

This street-cleaning machine, which has been invented and constructed by Messrs. Hentschel & Co., and has been fitted with electric propulsion by Gottfried Hagen, forty accumulator cells being arranged in the fore part of the vehicle. Each of these cells gives a potential difference of 2.6 volts, so that the whole of the battery is charged to its full capacity with 104 volts. Two 4-h.p. motors, actuated by this battery, are driving the fore-wheels, five forward and three backward and braking positions being provided for.

In addition to its electrical brake, the cart is obviously provided with a hand brake.

This sprinkling and cleaning cart has been found to adapt itself even to the most crowded thoroughfares, such as the Friedrichstrasse. The machine is about 3 meters shorter than those designed for horse-traction. Its steering capacities are said to be specially remarkable, the cart being readily turned round an almost immovable rear-wheel as soon as the slightest pressure is brought to bear on the steering lever, which is an invaluable advantage in dense traffic. The electric brake will act instantaneously even in the case of the highest speeds, the iron-tire wheels being stopped immediately without skidding or shaking. Owing to its uniformity of working, and the considerable volume of the water kettle, as well as to the far higher speeds of no-load runs, it is expected to accomplish a performance about twice as much as by horse-driven carts. The power consumption has been found to be extremely low, in fact far lower than anticipated. The output of the battery will accordingly be considerably higher than had been expected from calculation, and each charge will doubtless suffice for fifteen working hours. No breakdowns or disturbances in operation have so far occurred.

The introduction of these carts is considered by the managers of the Berlin street-cleaning department as a remarkable departure in the field of modern municipal hygiene.

KENTUCKY ROCK ASPHALT MACADAM.

By H. C. Innes, Cincinnati, O.

A new form of macadam roadway or pavement has recently been laid in several cities, the material used being crushed limestone, boulders, or some hard stone for a wearing surface and Kentucky rock asphalt. The method of construction is very simple and requires no expert workmen. Ordinary street tools and a steam roller is all the equipment needed. The roadway is graded to the required depth and crown, is rolled and about 6 inches of crushed stone spread over the subgrade. This is thoroughly rolled and compacted. Upon the rolled foundation a 2-inch layer of crushed stone about 1½ to 2-inch size is spread. This should be as hard a class of stone as can be procured. Upon this 2-inch layer is spread about an inch or an inch and a half of the pulverized Kentucky rock asphalt. The steam roller is then used, which forces the loose rock asphalt down into openings of the loose stone and even with the top of the 2-inch layer of wearing-surface stone. The rock asphalt is applied cold.

The theory is that the wear of the road material comes on the hard stone surface and the rock asphalt is merely used to fill the interstices or openings and in a measure to cement the loose stones into a compact sheet. Streets of this construction have been laid in Memphis, Tenn., Birmingham, Ala., Covington, Ky., and elsewhere.

The pavement has good claims, in that the road or street does not become dusty owing to the oily nature of the rock asphalt. It can be swept or washed. Travel tends to compress the surface rather than at the early stages to cause wear. There is less chance for washing on steeper grades from rain, due to a greater compactness of the surface. Smooth surfaces are as a rule more dusty than jointed surfaces, unless oily in material, which may tend to lessen this nuisance.

This class of roadway using the rock asphalt requires a little more care than is usually employed in constructing the stone macadam roads. It is somewhat higher in price, possibly 25 to 30 per cent greater. It is easily repaired and can be done quickly without experienced forces.

Kentucky has many deposits of sands impregnated with bitumen. It can be found in quantities and many openings have been made, materials mined and used in various places. Analysis shows from 4 to 12 per cent of bitumen and sands rather round and uniform. From the mesh composition of sands the voids in same are very great. The bitumen is more of a maltha or liquid asphaltum, which hardens somewhat by heating or exposure. Owing to its lack of density, better results could be obtained by giving the finished street surface a coating of a high-grade pure asphalt or mineral rubber cement which would not be affected by water, thus tending to completely seal the surface, and add to its density. It could be applied hot and broomed over the surface, intermixing limestone dust or natural cement sweepings, and rolled again. This filling coat and stone dust would be a small item to the square yard, hence would add but a few cents. The results, however, would be greatly improved.

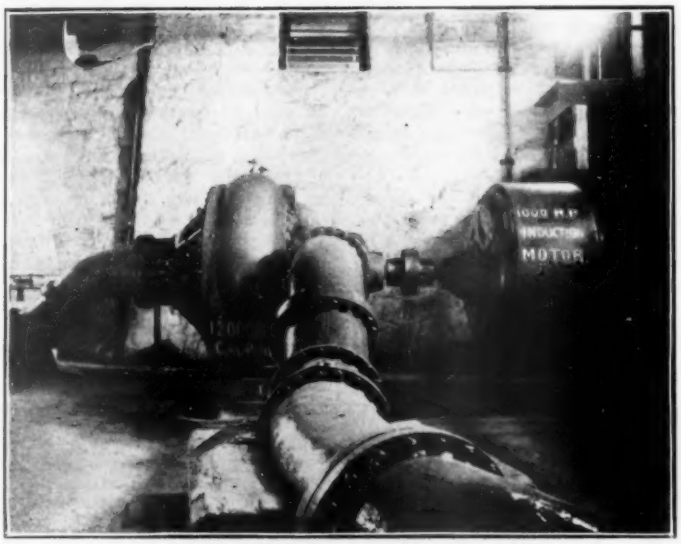
This Kentucky rock asphalt can be obtained from various deposits through the State. It would cost about $5.00 to $7.00 per ton delivered in Cincinnati. A ton of loose rock would cover 1 inch thick about 20 square yards.

It is also possible to give an old macadam road or street a 2-inch wearing surface of hard crushed stone and Kentucky rock asphalt, after shaping and dressing of the old macadam. For best results the surface should be dense, excluding water, have suitable crown, be well rolled and as rich Kentucky rock asphalt should be used as can be procured. The petrolene in the rock asphalt hardens somewhat by exposure and is converted into asphaltene.

THE DULUTH, MINN., ELECTRIC, GAS AND STEAM ENGINE PUMPING STATIONS.

By Frank C. Perkins, Buffalo, N. Y.

Electric power is now utilized by many of the municipalities in the United States as well as in Europe for pumping service and gas engines are also utilized on the score of economy, both of these new means of driving pumping plants replacing to a certain extent the steam engines formerly employed.



DULUTH, MINN., WATER WORKS.
Electrically Driven Centrifugal Pump.

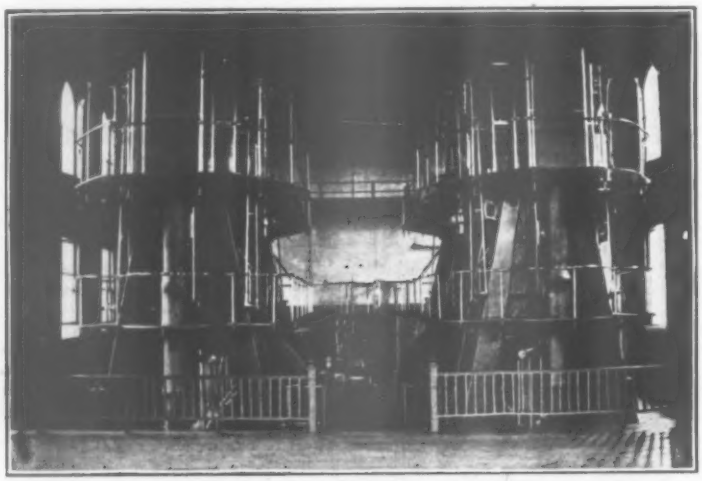
DULUTH, MINN., WATER WORKS.
Gas Engines Supplying Middle System.

The water works system of Duluth, Minn., was started several decades ago, the Duluth Gas and Water Company having operated under a franchise since 1893 and extending for a period of thirty years from that date, but now under municipal ownership.

The water is pumped from Lake Superior to reservoirs, the intake pipe being laid nine miles down the lake from the center of the city. It leads from a crib about one-third of a mile from the shore, the pipe being at a depth of sixty-five feet. One of the two pumping stations is located at Lakewood and is provided with an electric pump of twelve million gallons capacity, together with two pumping engines of six million gallons capacity.

One of the reservoirs has a capacity of fourteen and a half million gallons and another of five million gallons. At one of these reservoirs there is a gas engine pumping station for the middle system, each of the gas engines in this plant having a capacity of sixty horse-power. Connected with this middle system there is another gas engine pumping plant located at the tanks at an elevation of two hundred and fifteen feet above the pump house just mentioned, a twenty horse-power gas engine and a sixty horse-power engine supplying the upper system at a further elevation of nearly two hundred feet, or a total height of over six hundred and fifty feet above the lake. In addition to the two reservoirs above mentioned there is another or third reservoir in service of ten million gallons capacity, and the water is pumped to these reservoirs two hundred and ninety feet above the lake. The largest part of the city of Duluth is located on the side of the hill and supplied from the lower system, which is within the hydraulic level of these reservoirs.

The electrically driven pump is said to have cost twenty-five thousand dollars and was built by the General Electric Company of Schenectady and the I. P. Morris Co. The centrifugal pump built by the latter firm has a capacity of twelve million gallons and is driven by one thousand horse-power induction motors of the General Electric type, seen in the accompanying illustration, Fig. 1. It is stated that this pump has a double pumping capacity and may be utilized to increase the supply or while repairing the other engines. The interior of the Lakewood pumping station is shown in the accompanying illustrations, Fig. 2, showing the two triple expansion condensing vertical pumping engines, each having a capacity of six million gallons in twenty-four hours. The interior of the middle system pumping station is shown in the accompanying illustration, Fig. 3, the latter showing the two fifty horse-power engines in this plant. The largest reservoir has fourteen and a half million gallons capacity.



DULUTH, MINN., WATER WORKS.
Two Triple Expansion Condensing Vertical Pumping Engines.

There has been an auxiliary system provided at Duluth Heights in which the water is obtained from four driven wells of six inches diameter arranged to discharge into a ten-inch overhead main leading to a receiving basin into which the water flows continuously and from

which it is pumped, so that suction from the well is prevented and a total of eighty-two thousand gallons is available from these wells per day.

It is interesting to note that in the middle system 43,362 feet of water and gas mains have been laid under the direction of L. N. Case, the manager of the Duluth water works. It is stated that the total mileage of piping now in use by the Duluth Gas and Water Co. is about 100 miles, varying from 3 inches to over 3½ feet in diameter. There are over 2,000 meters in use with service connections for nearly 7,000 consumers, while about 700 hydrants have been provided. This water-works system at Duluth is operated by three forms of power—steam engines, gas engines and electric motors, all working, it is claimed, to the best advantage and with high economy.

THE PARKS OF MADISON, WISCONSIN.

The park system of Madison, Wis., is unique in that it is the result of private effort rather than of public expenditure. The Madison Park and Pleasure Drive Association was formed about 1892 and has raised by private subscription each year amounts ranging from $655 in 1894 to $34,601 in 1905, or a total for 15 years of a few cents more than $180,000, an average of $12,000 a year. The public has become so accustomed to this method of raising funds that postal card notices bring in $5,000 a year, with no further solicitation.

Besides the goodly sum above named the railroads have contributed $59,000 for stream improvement and other work of the association and various persons have contributed money for land, bridges, etc., amounting to some $18,500 and some 80 acres of land and 33 acres in water and parkway. The city has also spent some money on bridges and stream improvements, such as $5,700 for the Yahara river and $6,000 for a bridge in 1907.

The accompanying photographs, for which we are indebted to Secretary Charles N. Brown, of the Association, show the results of the excellent work done under its care.

The development and support of so extensive a work by private effort is exceptional and has only been possible through the self sacrificing efforts of members of the Association. They have so thoroughly proved the value of parks to the city that Madison should step in and shoulder a large share of the burden, if not all of it, if the same or equal service in design and superintendence can be secured.

BACTERIA IN HOUSE DRAIN PIPES.

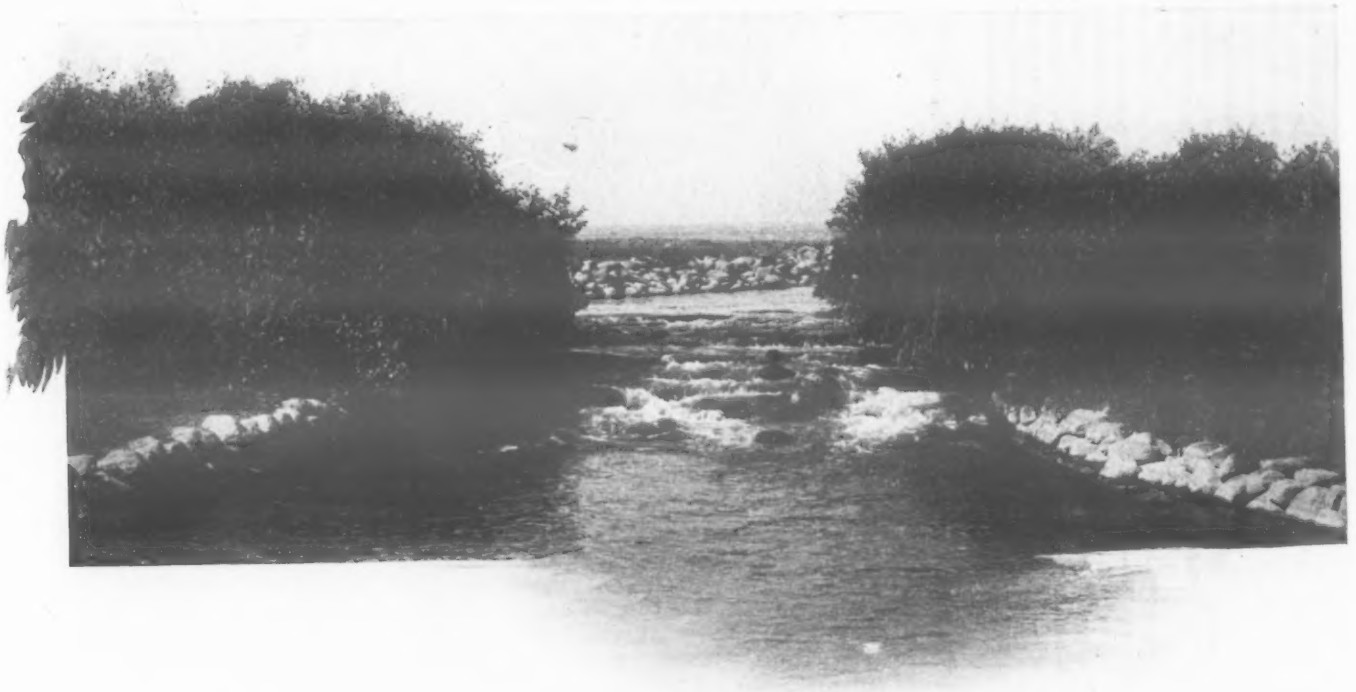
By Dr. F. J. H. Coutts, Medical Officer of Health, Blackpool, England.

The most remarkable set of recent experiments on the subject of the carriage of bacteria by the air passing through drain pipes which have come to my knowledge are those of Major W. H. Horrocks, R. A. M.C., recorded in a paper read before the Royal Society, and printed in Public Health for May, 1907, under the title, "Experiments Made to Determine the Conditions Under Which Specific Bacteria Derived from Sewage may be present in the Air of Ventilating Pipes, Drains, Inspection Chambers, and Sewers." It is in this paper that the new facts arise which I think should be carefully studied in any fresh consideration of the sewer ventilation question.

As this paper does not seem to be so well known as I think it deserves, some description of Major Horrocks' well-planned and carefully-managed experiments may be welcomed.

In his first group of experiments, sewage inoculated with a rich growth of B. prodigiosus was placed in the bottom of a deep glass jar; 4 inches above the surface of the sewage Petri plates of nutrose agar were placed, and the surface of the agar exposed to the air after the sewage had been agitated to form bubbles. No colonies of the B. prodigiosus were found on the Petri plates after incubation, and similar negative results were obtained with the typhoid bacillus. Therefore the conclusion to be drawn is that in the absence of air currents bacteria are not ejected to a height of 4 inches by the bursting of infected bubbles.

But very different results were obtained when air currents were present. Petri



MADISON WIS., PARK SYSTEM.

I. Tenney Park, The Cascade.

plates suspended in the ventilating shaft of an intercepting trap 9 feet above the surface of soapy water containing the B. prodigiosus were infected readily, thus showing that currents of air passing up the vertical pipe could carry bacteria separated by the bursting of bubbles. Similarly, he found that bubbles rising naturally through stagnant water in a catchpit may eject bacteria, which will be carried away by currents of air passing over the surface of the fluid. In his next experiments three 2-feet lengths of 6-inch drain pipe had a rich emulsion of B. prodigiosus poured into them and equally distributed over their inner surface. When the pipes were quite dry they were arranged by clay joints so as to form the vertical ventilating pipe on a length of drain. Nutrose-agar plates were then suspended in the vertical ventilating pipe and sewage allowed to flow along the horizontal drain for 20 minutes at a rate not exceeding 3 feet per second. On incubation the plates showed colonies of B. prodigiosus. As the sewage passing through the horizontal pipes did not contain this bacillus, nor the outside air, it is reasonable to assume that the currents of air caused by the flowing of the sewage carried up dried particles of B. prodigiosus detached from the walls of the vertical pipes.

The next group of experiments were to determine whether specific bacteria were ejected into the air of sewers from sewage flowing under normal conditions.

The trap of a 6-inch disconnecting trap was filled with sewage. Petri plates were suspended in the vertical ventilating pipe 6 feet 9 inches above the sewage. Sewage containing typhoid bacilli was then allowed to flow down the drain on the house side of the trap, and collected from the drain on the sewer side of the trap. The rate of flow was regulated to be not more than 3 feet per second. Numerous typhoid germs were found on the plates. Similar experiments with B. prodigiosus were successful to heights of nearly 12 feet above the trap.

The next series of experiments were arranged to test the value of a disconnecting trap in protecting a house-drainage system from microbes in sewer air. Pipes were arranged to represent a short house-drainage system, with an intercepting trap and vertical ventilating pipe. Beyond that, on the sewer side of the trap, was another vertical pipe to represent a sewer ventilator. Plates of nutrose agar were suspended in both vertical pipes. Sewage containing B. prodigiosus was then allowed to flow along the pipes representing the sewer, at a rate not more than 3 feet per second. Colonies of the germ were found in the vertical pipe representing the sewer ventilator, but none in that representing the ventilator on the house side of the trap. Even when the fluid in the trap was disturbed by a 3-gallon flush every five minutes no collection of B. prodigiosus was found on the plates on the house side of the trap, showing that the trap effectually protected the house drains from contamination from the sewer side. Removing the trap, but otherwise leaving the experimental system precisely as before, on pouring infected sewage down the sewer pipes and flushing the house drains by a 3-gallon flush every five minutes the B. prodigiosus appeared in the ventilating pipe of the house drains as well as in that of the sewer. These results show that a disconnecting trap prevents germs present in the sewer passing into the house-drainage system.

The next series of experiments are of very great value, especially as they were made with actual and not experimental drainage systems. In a newly laid house-drainage system plates were suspended in the disconnecting chamber, and a plate was fixed in front of the air inlet of the system (the low ventilator) which was furnished with a mica-flap valve. An emulsion of B. prodigiosus was placed in the pan of the house water closet, which was then flushed out. When the plates were incubated colonies of the special germs were found on every plate. This reslut is significant of the inefficiency of the ordinary mica-flap valve. At a military hospital plates suspended in the top of a 6-inch ventilating pipe 50 feet above the ground level were infected when an emulsion of the B. prodigiosus was placed in the pan of a water-closet in the basement, which was then flushed out.

Another experiment was instructive, in which plates placed in an intercepting chamber (C) at one corner of a military hospital block became infected by bacteria flushed out of a water-closet pan at another corner of the block, although the sewage had to pass first through one intercepting chamber (B) and along a considerable length of sewer. The cause of this result was found in the stopper of the rodding arm of chamber C being missing; when it was replaced, plates in chamber C did not become infected. The only other experiment I need mention is one which proved that the typhoid germ itself could be carried from the surface of liquid in a trap up the ventilating pipe when stools from an enteric fever patient were allowed to flow through the trap. This shows that bacteria in their normal condition in infected sewage can be carried into the air just as the naked bacilli in the preliminary tests.

The results obtained by Major Horrocks will no doubt be tested by other experimenters, but I think that no one who

closely studies the records of his experiments will fail to agree that they deserve serious consideration. Personally I feel satisfied that further experience will only serve to confirm these conclusions. Their bearing on the question under discussion is sufficiently obvious.

The simplest plan of dealing with sewer ventilation is, if I may venture on an Irish bull, to have not ventilation at all. This is the solution of the problem, I suppose, in certain towns such as Bristol and Cheltenham. But in such a case it is obvious that a sudden inrush of sewage, or a sudden expansion of sewer air through the introduction of hot liquids into the sewer, or other cause, will lead to the breaking of the seals of the intercepting traps in the vicinity and the access of sewer air into the house drains. The gases will come out at the low vent, and if the drains are at all defective there is a great tendency for the gases to penetrate into the house itself. We know that the difference of temperature between the interior of the house and outside is sufficient to draw any foul gases in the adjoining subsoil into a building.

Of actual methods of attempting to ventilate sewers, the easiest and cheapest is to provide surface-level openings in connection, either directly or indirectly, with the manholes. Probably more sewers have been laid on this plan than on any other. But common sense and actual experience tell us that these surface openings are frequently offensive and cause a nuisance. Horrocks' experiments give us good reason for believing that, in addition, they are a danger to health, and that disease germs may be inhaled by persons passing over such openings. I am under the impression that various safeguards which have been proposed in connection with this method—such as filtering the escaping air by means of charcoal or some chemical—are rarely used now. The charcoal method is certainly ineffective as soon as the charcoal becomes wet; also, all these methods must create great obstacles to the free passage of air, besides being costly and troublesome to maintain in anything like proper working order.

The next method of sewer ventilation which I shall refer to is dependent upon the abolition of the intercepting trap. This is a method which has found much favor of late, especially among engineers, whereas most medical officers of health I believe have been opposed to it. At first sight it appears an excellent solution of the difficulty, as, by having tall ventilating shafts on each house drainage system, you have the sewers connected to an immense number of ventilating shafts, each of small area, but combined giving a splendidly ample area of openings for the extraction of foul, and the admission of fresh air. The local authorities have nothing to pay in the shape of wayleaves, no trouble to find suitable positions, no expense of upkeep, no complaints of smells from surface-level ventilators. Some of the soil-pipe ventilators no doubt act as inlets, and others as outlets, and most of them act sometimes in one direction and sometimes in the other. The total result is very satisfactory, however, from the point of view which looks only at the constitution of the sewer air. Probably under such a system the air in the sewers would never smell very foul. But if Horrocks' experiments prove anything, they prove the value of the intercepting trap in preventing the air of sewers from contaminating the house drains, and in cutting off the drains of one house from its neighbor, so that the presence of typhoid excreta in the drains of one house will not mean the possible and even the probable passage of the typhoid bacillus into the drain air of the adjoining and other property. In such a case a comparatively minute leak in the drainage system close to the house might be a very great danger. It is precisely the joints close to the house which, even if sound at first, are apt to become defective owing to a slight settlement of the foundations. I think there is very good reason for the almost universal desire among tenants to know that their drains are effectually cut off from all direct aerial connection with those of their neighbors and from the sewer. I am therefore of opinion that this method, although very tempting on account of its simplicity and cheapness, is dangerous, and cannot be recommended.

In some places where they have not gone so far as to abolish intercepting traps, ventilating pipes of light iron, such as is often employed for soil pipes, and of 4-inch or 6-inch diameter, are employed, connected directly to the sewers, but running up house walls. These, of course, if carried well above the roof, are safe so long as all the joints are airtight, both those above as well as those underground. But any settling of the house walls leads to a defective joint at the most important place—namely, the connection of the iron pipe to the earthenware drain. Any leak in this situation allows sewer-gas to enter the house. The fear of this creates great difficulty nowadays in getting permission to fix these pipes to a house side; personally I should have much objection to living in a house to which such a sewer ventilator was attached. There is less objection to affixing such pipes to the walls of buildings such as stables or warehouses. I have seen them attached to telephone or telegraph posts, but I should imagine the effect of strong

MADISON, WIS., PARK SYSTEM.
II. Triangle Park. Lake Mendota Drive.

winds would rapidly cause a defective joint at the foot of the pipe.

Attempts have been made in some places to secure effective ventilation by connecting large diameter pipes to mill chimneys or furnaces to obtain a strong extracting effect. Unfortunately it is found that the suction may be so strong as to unseal the intercepting traps in the immediate neighborhood of the ventilator, while the effect is felt very slightly at a little distance. Shone's system of mechanical ventilation carries the principle of mechanical extraction very much further, and is undoubtedly very ingenious, with its scientifically arranged size of air inlet proportioned to the distance from the source of extractive power. It seems to me, how-

MADISON, WIS., PARK SYSTEM.
III. University Drive.

ever, that the cost both of installation and of working must necessarily be very high, while any accidental or unauthorized inlets would be liable to upset the working of the whole system.

Certain forms of ventilating lamps in the shape of small iron independent columns give a certain extracting effect, and are at the same time supposed to burn up and destroy organic matter and effectually kill any germs present. I have no doubt that this does occur to some extent, but we have as yet no satisfactory evidence that this disinfection of sewer air is so complete as to render these lamps quite safe to be employed in such close proximity to the windows of dwelling-houses as would sometimes be necessary. Besides, with a sufficient number of these lamps to give efficient ventilation the cost of the gas consumed would amount in the course of the year to a very considerable item.

To my mind the only method of sewer ventilation which can be safely recommended at present is by means of independent ventilating columns of iron or steel, tall enough to carry all dangerous gases well above all dwelling-houses, placed as near the sewers as possible, and with the smallest possible number of bends. Where lighter but still gastight shafts can be erected against buildings, not used for constant occupation by human beings, these might also be used. It is no use labeling one as inlet and another as outlet, because each column will act sometimes in one direction and sometimes in the other. I believe, however, that natural agencies would keep up air currents, such as the wind blowing over the top of the shafts and the effect of the sun's heat, which often, I think, acts very strongly in the case of an iron shaft. Such a system gives us at any rate an outlet for sewer-gases, and prevents the forcing of house traps. I do not believe that it would give a pure air in our sewers under all conditions, such as a state of little wind and a close approximation of temperature outside and inside the sewers, but under ordinary circumstances it will keep the air sufficiently safe to allow of the workmen entering the sewers when necessary. Personally this, I think, is all we can expect or require, and would be very much better than the state of things now existing in many places, in which a policy has imperceptibly grown up of closing all the surface ventilators as complaints occur, until at last the sewers are left entirely unventilated, giving rise to occasional forcing of traps and the consequent dangers.

REINFORCED CONCRETE IN THE CONSTRUCTION OF HIGHWAY BRIDGES AND CULVERTS.*

By James A. Mortland, C. E., Grinnell, Iowa.

The one great problem of our roads and highways in the Middle West is how they can be made serviceable for the twelve months in the year and be kept up at a minimum expense after time and money have been expended on them. It is clearly out of the question for the roads to be built out of gravel or stone in many places in this section of the United States, on account of the remoteness and the excessive cost of the necessary materials. The problem of making good dirt roads is yet to be worked out, but it is possible to secure much better highways if the road supervisors or board of county commissioners would establish grades and carry out a drainage system along the public roads, and by a systematic filling of the low places and cutting down the hills we would secure roads infinitely better than those we travel over at present.

*A paper before the Nebraska Cement Users' Association.

The building of roads and bridges was necessary, in the earlier days, to make the growth of any section of the country assured; but in all the Middle West the country has developed and the land increased in value almost phenomenally, and yet such a small amount of money has been expended on the roads and bridges.

Along with any road improvement we have the question of bridges across the streams and dugouts. These bridges must be built across two classes of streams: living streams, that flow the year round, and intermittent streams that flow only during the spring months, or after heavy rains.

There are several kinds of material for the construction of such bridges. We have to do with:

1. The wooden bridge, with pile bents.
2. Steel frame, or superstructure, on piling.
3. Steel superstructure on masonry abutments, with wood floor.

4. Steel superstructure on abutments, with a concrete floor.

5. Large sewer-pipe or tile.

6. Culverts of smooth or corrugated steel pipe, galvanized or painted.

7. Bridges and culverts of reinforced concrete, of any span or shape.

We have now before us seven types of bridges or culverts, all of which have been used on our highways with varying degrees of success. The suitability of each can best be determined by studying the many conditions which such a structure must undergo.

A bridge or culvert on any highway must necessarily be such as to require little attention or care. It is safe to say that we hardly have a bridge on any of our highways that is regularly inspected from time to time. Not until a plank in the floor is broken, or a washout carries away the filling from the approaches of the bridge, or by some condition it is made a dangerous crossing, is it inspected or looked after. In other words, it is necessary to build bridges or culverts that require little care and maintenance.

Now let us consider the use of the wooden bridge in highway improvement. At many places wooden bridges are built over very small streams where the actual span across the stream is very much less, on account of the fact that it is impossible to hold the road leading up to the bridge and to keep the stream under the bridge. I will cite two cases: One where a concrete arch bridge, 35-foot span, was built to replace a wooden bridge 80 feet long; the other, where a 40-foot span concrete bridge replaced a wooden structure 66 feet long.

To hold a wooden bridge in place the piling must be in solid ground; hence we always have so much bridge spanning dry ground, and with the plank roadway there is always the wearing out of the planks, and with that the possibility of having a dangerous crossing.

Speaking of the excessive length of wooden bridges, there is one county in Iowa that has ten miles of wooden bridge floors to maintain, and this county is below the average in the number of bridges.

To make culverts of wood, where any amount of earth is to be placed on top, is temporizing and in the end will cost more to replace.

Bridges with a steel superstructure on

MADISON, WIS., PARK SYSTEM.
IV. Lake Wingra Drive.

piling, with wooden floors, are not much better than the wooden bridges and are of no more use in making our highways permanent than an all-wooden structure. Steel bridges with concrete or masonry abutments and wood floors are not at all so desirable, as the floors rapidly wear out, the life of a plank floor on a bridge with ordinary travel is not more than five years, with many new planks needed from time to time in that interval. Steel bridges on concrete abutments, with concrete floors, are wholly desirable, but are likewise expensive; in fact, it is possible to construct a concrete bridge as cheaply in ninety-nine cases in a hundred, and the concrete bridge has the advantage of not requiring the painting and suffers no depreciation from the elements.

So far we have considered bridges for living streams or for locations where it would not be policy to narrow the waterway to any great extent. But in this section of the country, in all the Middle West, we might say, about one bridge in five spans a living stream, the other four-fifths spanning gullies and dugouts that are dry for a greater part of the year. Thus we have a condition presenting itself to the highways as it has to the railroads, and we find the railroads have almost invariably constructed such a water-way by means of culverts under their tracks, so as to carry a normal rainfall and filling on top, giving them a continuous roadbed; with a flood, the water may be held back for a time, but soon can get away without any great damage from backing up. It is possible to adopt this method of placing culverts in such places on the highways, and by filling on top a roadway is obtained that is permanent and with no danger of ever giving out. By reducing the length of the bridge and placing a culvert the resultant cost of a permanent culvert is oftentimes less than what it would take to build a wooden bridge necessary to span the ditch.

Here are two instances of reducing the waterways, or rather of filling up an open ditch: First, where three wooden bridges had been built in thirty-five years, the last one was 44 feet long, and it had served its time, so it was removed and a concrete culvert was built with inside dimensions of 4x5 feet; and this culvert has proved ample for all the water that can flow in the ditch. Another bridge 56 feet long which has grown from a span of 16 feet, in ten years was rendered unsafe by the bank slipping in, breaking off the piling. This was replaced with a concrete culvert five feet square and thirteen feet of dirt placed on top, making a permanent roadway instead of having a plank floor over a deep gully. These two cases show that often there is a plank roadway where it would be possible to have a dirt road. Then such gullies or washouts are usually at the foot of a hill or between hills, and the cutting down of the hills and filling in of the culvert improves the whole road and makes a permanent improvement.

Having these conditions, it is well to consider the various materials available for constructing such culverts as needed.

Large sewer-pipe has been used with varying degrees of success. Much depends on the placing of the pipe and the character of foundation on which they rest, and in the cementing of the joints. The disadvantage is in the frequent unequal settling of the pipe when the earth is filled in, and this causes a break in the flow of the water and it will tend to fill up the pipe, likewise increasing the chances of undermining the pipe. To make a concrete footing for the pipe and to carry this up the sides to the horizontal diameter adds greatly to the cost, while it improves the value of the pipe as a culvert.

End walls over the top of the pipe are needed to prevent the fill from washing down into the opening; also wing walls are necessary to hold the dirt on the sides. The attaching of these walls to the pipe is a difficult matter and is usually very unsatisfactory, owing to the fact of not being able to get a good bond between the pipe and the concrete or mortar of the walls.

There have been many types of circular steel culverts brought into the market in the past few years having some merit, but the fault of rusting. The same objection of attaching wing and end walls to this type of culvert as with sewer pipe is true. For any given area of carrying capacity it is possible to construct concrete culverts as cheaply as the steel pipe, and the concrete culvert is with wing and end walls.

Having considered briefly about all the kinds of bridges and culverts in use at present, let us now turn our attention to the adaptability of concrete as applied to the problem of making permanent highways of travel for this generation and several following generations.

Concrete is a mixture of cement, sand and crushed stone, with no direct planes of cleavage or seams. It is brittle as stone and can be used to support enormous loads as in foundations, bridges and the like, provided it is so placed as to receive no tension or pull. With the addition of steel in the concrete to withstand any pull we have a combination of materials excellently adapted for many purposes where stone could not be used.

In an ordinary beam, of any material, the upper surface is in compression and the lower surface is in tension, or the par-

ticles of the lower side of the beam tend to separate when a load is applied on the top surface. The natural arrangement, therefore, in a concrete beam is to design a beam so that the upper portion is composed of concrete, which takes care of the compression, and with steel imbedded near the bottom to resist the pull or tension. The concrete, by surrounding the steel, makes a surer bond between the two materials, and likewise protects the steel from any action of the elements or any other causes destructive to it. Concrete and steel expand and contract almost exactly the same, so it is safe to use the combination without the possible danger of separation due to any change of temperature. To make a safe combination of concrete and steel it is necessary to know just how much load each can stand, and just where the steel must be located to take care of every bit of tension in the concrete. Then, too, there are other secondary stresses in the interior of the beam, a tendency to slide or shear, and partly a tension or pull which must be guarded against by properly placing the steel rods. Because of these complications of stresses it is necessary in the designing of bridges and culverts to have a knowledge of these principles in order to make permanent and lasting structures.

Too many culverts and small bridges are being built today that are not in any way permanent, and such work as this will do great harm in the growth of the use of concrete for such purposes. These faulty structures may in some cases be credited to the desire of some one to economize, by using too weak mixtures, and in others to the contractor's zeal to make a large profit. Ignorance of workmen is sometimes the cause of a failure. In no case should a culvert or concrete bridge be built by the cut and try method, for this will frequently show a failure when the forms are removed.

Recently I had occasion to inspect a culvert, of reinforced concrete, that had been built less than three months and had not yet been subjected to any freezing or heaving due to the frost. This culvert had apparently been built by the foreman in charge without any plans or directions, for it was badly cracked from the weight of the earth load. The fill on top of the culvert was 10 feet. These cracks were generally at right angles to the center line of the culvert, showing that the constructor did not know or paid little attention to the many stresses on such structure. Reinforcing had been left out of the bottom entirely, showing that no attention was paid to the upward pressure on the bottom, which was broken in several places and was heaved up more than six inches. Such designing and construction is in no wise permanent and is as expensive in first cost almost as a culvert built along proper lines.

It is not the purpose of this paper to take up the design, so much as the practical principles of construction of culverts and bridges of concrete.

Portland cement should always be used for concrete construction, because it is stronger and more reliable and hardens more quickly than natural cement. The cement should be of a standard brand and not liable to expansion or disintegration, fine and of uniform quality. It should be free from lumps and always stored in a dry place.

For the aggregates in concrete the sand should be clean and coarse, or a mixture of coarse and fine, the coarse grains predominating. It should be free from clay, loam and sticks, organic matter and other impurities.

Screenings or crusher dust from broken stone may be substituted for sand by altering the proportions so as to give a dense mixture and the same relative volume of aggregates.

Gravel when used should be composed of clean pebbles, free from foreign matter, and containing no clay or any material adhering to the pebbles. It should be screened to remove the sand and should be mixed afterwards in the proper proportions. However, if by test the gravel runs in the proportions of two and one-half to three parts of sand to from four to five parts of pebbles, it can be used without screening.

Broken stone should consist of pieces of hard, durable rock, such as trap, granite, limestone or conglomerate.

The water used in mixing should be clean and free from acids or strong alkalies.

Steel for reinforcing should be of high tensile strength and of such shape as to form a firm bond with the concrete.

In mixing concrete for the construction of culverts and bridges the proportion should be such as to give the densest concrete with the maximum strength of the cement motar. The mortar mixture of sand and cement is generally two parts of sand to one of cement, yet I have used two and one-half and sometimes three parts of sand and obtained a mixture that proved dense and for walls and footings proved as good as to the two to one mixture.

The stone aggregate in the proportion of four parts will in most cases make the most desirable mixture, as it allows for enough mortar to surround all the stones and leaves no stone pockets in the concrete surface.

Mixing concrete is a vital thing in the strength of a structure, whether large or small. "Mix well and mix wet" should be

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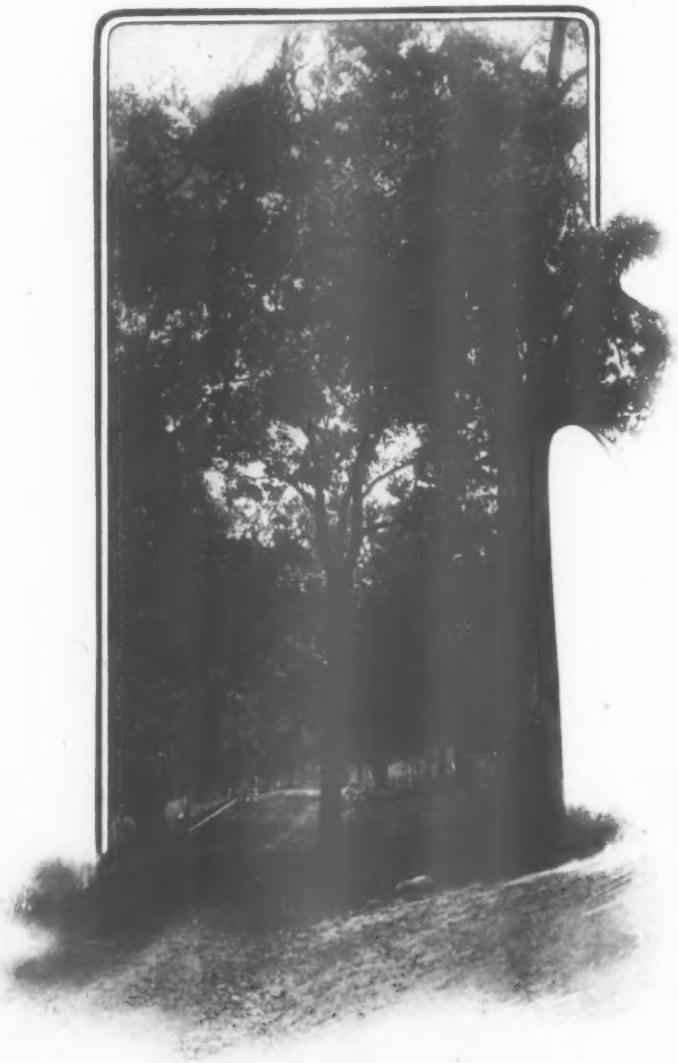
V. Lake Mendota Drive.

pasted in every man's hat on the work, and by so doing many faults will disappear.

Exposed surfaces of concrete may be made sufficiently smooth by spading, so as to force the stones back and the mortar to the surface of the forms. The forms should be sufficiently tight to prevent the mortar running out. With these precautions, surfaces can be obtained that require very little patching or plastering to make a neat job.

The forms should be made of lumber sufficiently strong to hold itself in line without an excess of bracing, and not bulge or be thrown out of line by the workmen filling them. All exposed surfaces should be made with dressed lumber. All joints should be fitted neatly. The lumber best adapted for building the forms for culverts and bridges is 2x6-inch stuff dressed and with 4x4 inches for stays. The handiest ties are half-inch bolts of a length necessary to hold the



MADISON, WIS., PARK SYSTEM.
VI. Lake Mendota Drive.

forms together. With care in removing them they can be used several times. Bolting the forms requires few nails and makes a form that can be easily taken down. Then it is possible to get the wall of the required thickness and be assured it will not bulge out of line or shape.

The time necessary to leave the forms in place varies considerably with the weather. But under ordinary circumstances wing walls and culvert sides can be removed in three days.

Slabs of not more than 6-foot span may be removed in five days. Long arch spans and slabs require no less than ten days of good drying weather. In freezing weather the forms should be left in place as long as possible.

Reinforced concrete culverts can be constructed successfully for all spans up to 15 feet and give perfect satisfaction. They should be designed to carry the maximum earth load that could be put on top, as in the grading and leveling the roads would sometimes make an increasing earth load, from year to year.

The wing walls should be at least 10 feet long if the earth fill is more than 5 feet, and an end wall should always be high enough to prevent the dirt from spilling over into the waterway of the culvert.

The wings should in all cases be placed at an angle of 30 degrees with the center of the culvert.

End walls across the top of the culvert should be no less than 4 feet high, and if the fill is more than 8 feet they should be 6 feet high. The higher the wing and end walls the wider the width of the roadway.

Bridges of spans greater than 15 feet and up to 30 feet should be with concrete girders. Spans greater than 30 feet should be arched.

The design and construction of the concrete bridges should always be in the hands of competent engineers and workmen.

With concrete bridges we have something that improves with age and is as permanent as anything can be. All that is needed to make them so is the use of the best material, good workmen and designs that have the approval of engineers versed in the work.

EXPERIMENTS WITH TAR AND OIL ON THE HIGHWAYS OF RHODE ISLAND.*

By Arthur H. Blanchard, Assistant Engineer State Board of Public Roads, Providence, R. I.

It is practicable to recognize three classes of highways existing outside of the city limits, the classification being based on the amount and character of the traffic to which the roads are subjected. Naturally these classes merge into and overlap each other in many cases, but the classification will suffice as a basis for comparison. The first class includes interstate trunk lines and the popular routes of travel. The second class includes intrastate trunk lines passing through towns, the highways connecting towns situated within a few miles of each other and the secondary streets of towns. The third class includes feeders leading to towns and highways of the first and second class from sparsely populated parts of the country districts, those connecting towns which are many miles apart and the transverse feeders in towns.

The highways of the first class will undoubtedly be subjected to the heaviest motor car traffic, although not necessarily to the heaviest commercial traffic. The highways of the second class will probably carry heavy commercial traffic and a limited amount of motor car traffic. The third class of highways will usually be subjected in amount, at least, to the ordinary country highway traffic.

The maintenance of highways of the third class which are constructed either of earth, gravel or broken stone, has been thoroughly and satisfactorily considered in the past. Highways included in the first and second classes, being subjected to a more or less heavy motor car traffic and an augmented commercial traffic, demand an entirely different method of maintenance and in many cases a modified construction of the broken stone surface. The amount of traffic and the speed attained by motor cars are the important facts to be considered in the discussions of methods employed for maintaining highways of the first and second class.

The construction of tar macadam in 1906 and 1907 on the Post Road in the Town of Charlestown was done under the supervision of the state engineers, the object being to obtain a road at a minimum cost which would withstand the de-

*A paper read before the American Association for the Advancement of Science.

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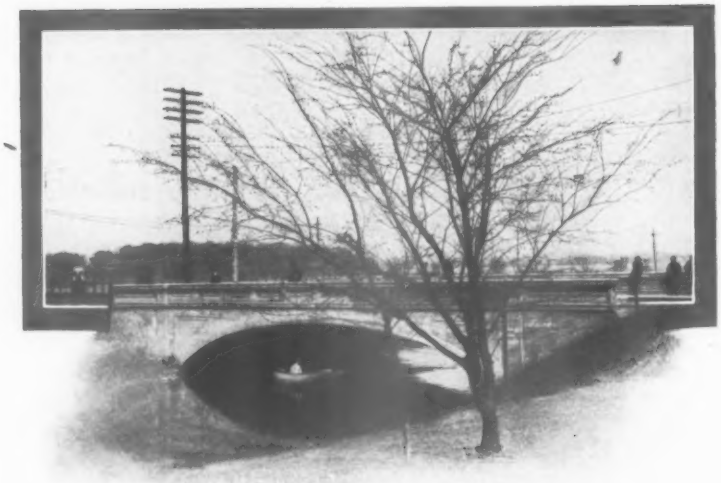
VII. Site of Steensland Bridge, 1897.



MADISON, WIS., PARK SYSTEM.
VIII. Yahara Parkway, Williamson Street Bridge.

structive wear of swiftly moving motor cars. This State Road is a part of the interstate trunk line connecting New York City, Narragansett Pier, Newport, Providence and Boston, and hence belongs to class number one. With the exception of the addition of tar, the method of construction used was similar to that employed in the building of an ordinary macadam road. After the subgrade had been thoroughly rolled, the No. 1 broken stone, varying in size from 1¼ to 2½ inches in their longest dimensions was spread to a depth of 6 inches and rolled to 4 inches. Tar, which had been heated in an ordinary tar kettle to the boiling point, was then sprinkled on the rolled surface by means of dippers. The No. 2 stone, varying in size from ½ to 1¼ inches in their longest dimensions, was next deposited on dumping boards and thoroughly mixed with hot tar with the aid of rakes and shovels. This mixture was applied on the number one course to a depth of 3 inches and rolled to 2 inches. A thin coat of dust, which would pass through a half-inch mesh was then spread on the surface and then rolled into the No. 2 course to fill

up the voids to provide a smooth surface. It is, without doubt, unnecessary to state that the work was carried on only when the broken stone was dry.

The tar used in 1907 was produced at the Providence Gas Works and cost f.o.b. Providence, $2.75 per barrel. The freight from Providence to Niantic, the nearest railroad station, was $0.41 per barrel. The cost of the haul from Niantic to the State Road, a distance of 6½ miles, was $0.50 per barrel. The barrels cost $0.75 each, which amount, minus the freight to Providence, would be refunded by the gas company upon the return of the barrels. The location of the road rendered the return of the barrels an uneconomical procedure. The total cost of the tar per barrel was therefore $4.41. As two barrels of tar were used per 50 lineal foot of road, 14 feet in width, the cost per square yard of the tar used was $0.1132. The extra labor employed comprised three men at 20 cents an hour and two men at 17½ cents per hour. As the working day was ten hours, and 100 lineal feet of macadam surface was built per day, the cost per square yard for the labor was $0.0609. The cost of accessories, which would include rent or interest and depreciation of tar kettles and dippers, and cost of fuel, was $0.0054 per square yard. The saving per square yard by not using a watering cart at $4.00 per day of ten hours, was $0.0171. The total cost per square yard, therefore, of the tar macadam in excess of the ordinary macadam was $0.1024. The amount of tar used per square yard was 1.15 gallon.

In the fall of 1906, 350 lineal feet were constructed, the location being on a curve section of the interstate trunk line in Charlestown. This sample withstood the severe test of a hard winter admirably, and likewise resisted the wear of the traffic during 1907 without perceptible alteration. As these results were gratifying, the State Board, during the fall of 1907, constructed the mile of tar macadam referred to above. Although this experiment was undertaken with the primary object of securing a more permanent surface, another desideration resulted, namely, the elimination of the objectionable dust. After a tar macadam road, constructed as described, has been in service a month a large percentage of the loose dust is either washed away by the rain or has been raised from the surface, primarily by the motor car, and blown away by the wind.

During the construction of the above road there would occur at irregular intervals small areas of a spongy nature. The lustre of the tar was lacking on the coated stones and the entire mass appeared to be impregnated with oil. Without doubt this condition was due to a lack of uniformity in the composition of the tar mixture in the several barrels used. It is well known that the percentage of ammoniacal liquors, light oils and water in a given barrel of tar depends to a great extent upon the amount of tar in the tank from which the contents of the barrel were drawn, and also upon the nature of the treatment at the gas works.

During the fall of 1907, Central St., Narragansett Pier, which belongs to the second class of highways, was built of tar macadam, the penetration method of construction being adopted. The tar compound used, known as tarvia, was furnished by the National Coal Tar Co., of Boston, the amount used per square varying from 0.81 to 1.61 gallons, depending upon the size of the broken stone comprising the upper course. The macadam was constructed by spreading 6 inches of clean, dry No. 1 Connecticut trap rock on the rolled subgrade and rolling the same to 4 inches. On the No. 1 course was then spread 2½ to 3 inches of clean, dry No. 2 Connecticut trap rock, which was lightly rolled. The tarvia, which had been heated in the regular tar kettles, was next poured on the surface of the No. 2 course and allowed to penetrate. The depth of penetration varied from 1 to 2 inches, depending on the size of the stone comprising the upper course and the amount of rolling the surface had received. Trap rock chip screenings were then spread to a depth of ½ to ¾ inch and thoroughly rolled. There is no apparent reason why this form of construction should not give satisfactory results, but a year's service under traffic will be required before any opinion relative to its durability can be expressed.

As yet the Gladwell system of constructing tar macadam has not been tried in Rhode Island, but, without doubt, will be experimented with during the coming season. This system consists in spreading on the No. 1 course, after rolling a mixture of tar and chippings, to a depth of ¾ inch. On this is deposited from 2 to 3 inches of No. 2 broken stone, which is thoroughly rolled, thus forcing the mixture into all the interstices of the No. 2 course. The upper surface is sealed by painting with tar, after which a thin coat of fine screenings is spread and rolled.

The construction thus far employed of using tar as a preservative for roads already constructed is known as the painting method. In the fall of 1906 a section of 1,300 feet in length of the State Road in the Town of Tiverton was painted with tarvia furnished and applied by the National Coal Tar Co. The usual method was employed of sweeping the dust from the surface of the macadam with stiff brooms, thus exposing the mosaic surface of the No. 2 course. The hot tar was

poured on the No. 2 course and spread by brushing. A thin coat of sand was then spread over the tarvia coating. The price per square yard was $0.0804. This section was located on a hill having a maximum grade of 7.28 per cent, hence the durability and slipperiness during the service of the first year were carefully noted. The tarviated surface was able to shed the water to the gutters and to prevent the road from being gullied, while, contrary to the experience of English engineers with steep gradients, no unfavorable criticisms have been offered relative to slipperiness. The State Road in Tiverton belongs to the second class, but it is subjected to more than the average amount of motor car traffic, as it is a part of the interstate trunk line leading to the popular summer resort, Newport. After sustaining a season's motor-car traffic, the road surface has not scaled or been worn down to the No. 2 course.

In 1906 tar painting was experimented with on two curves on an interstate trunk line in the Town of South Kingstown. In both cases the edges have continually worn or scaled off.

During the month of August, 1907, one mile of macadam road of the second class,

MADISON, WIS., PARK SYSTEM.
IX. Yahara Parkway.

MADISON, WIS., PARK SYSTEM.
X. The New Yahara.

located in the village of Peachdale in the Town of South Kingstown, was tarviated. The method employed was similar to that used on the Tiverton road, except that the tarvia in this case was heated to 200 degrees Fahr. in a special tarvia heater and spread directly from the tank car. The price per square yard was reported as $0.0487. As a whole the work has proved satisfactory, although the tarvia coating has scaled off in spots and on the edges.

The treatment of macadam roads with oil during 1906 and 1907 by the State Board of Public Roads was undertaken with the idea of not only suppressing the dust but also of preserving the road surface. Without doubt some of the towns in Rhode Island which have experimented with oil only considered the results from the standpoint of the solution of the dust problem. During the month of July, 1907, 32,242 square yards of the State Road in the Town of Barrington were treated with an oil known as "petroleum residuum," which was supplied by the Standard Oil Co. from their tanks at Bayonne, N. J. The oil was applied cold by means of an ordinary sprinkling cart to the surface of the road from which the dust had not been removed. The amount of oil applied per square yard was 0.214 gallon. The cost of the oil in the tank cars at Barrington Center, which is on the State Road in question, was $0.046 per gallon. The cost of the labor per square yard was $0.0105. Some damage was done during the three or four days following the application, particularly to motor-cars, carriages and wearing apparel, but the coagulated dust did not pick up after the traffic had matted the surface, except during and immediately following a hard rain. The treatment was successful from the standpoint of suppressing the dust, and as the retention of the dust preserves the surface of a macadam road it has, without doubt, increased the life of the road. The application of the oil, however, did not furnish a binder of sufficient tenacity to prevent the No. 2 course from raveling when it was subjected to a combination of unfavorable climatic conditions and heavy motor-car traffic. The efficacy of this treatment was apparent after five months of service, but it is not expected that the surface will be in such condition in the spring as not to require a second application in order to make the road dustless. This highway belongs to the second class, receiving the normal amount of motor-car traffic for roads of this type.

The Highway Commissioner for the Town of Cranston has used oil on the town roads since 1901. The highways with but two exceptions belongs to the second and third classes, the two exceptions being parts of interstate trunk lines on the State Highway System. The effect of one application has lasted from ten to thirteen weeks, hence the usual practice has been to make two applications per year. The oil used, petroleum residuum, is obtained from the Standard Oil Co.'s plant at Bayonne, and costs delivered in tanks on side tracks in Cranston $0.46 per gallon.

The State Road in the Town of Middletown belongs to the first class, for although it is an intrastate trunk line, it is at the same time part of one of the popular drives out of Newport. This highway was treated during July, 1907, with dustoline, the number of square yards covered being 20,765. The dustoline was spread by means of a watering cart on the surface of the road from which the dust had not been removed. The total number of gallons used on the work was 7,261, but as some sections received two applications the amount used per square yard is indeterminate. The dustoline cost, f.o.b. Summit, N. J., $0.0775 per gallon, the total cost being $562.73. As the freight from New Jersey to Providence was $69.70 and the cost of labor required to spread the material was $97.66, the average cost of the application per square yard was $0.035. The efficacy of the treatment from the standpoint of laying the dust has not been questioned. After three months the effect of the application had prictically disappeared. An objection to its use has been offered due to the fact that motor cars throw small coagulated particles of dust into the air, which are decidedly injurious to wearing apparel.

Dustoline has been used on many of the principal boulevards of Newport, giving perfect satisfaction, according to the statements of the officials of the Department of Streets and Highways. The object of the treatment was to suppress the dust more satisfactorily and economically than had previously been done by watering.

Judging from the results of the experiments made in Rhode Island and elsewhere, it is obvious that investigations should be made during the coming season covering the following important subjects: 1, Relation of the composition of tar to the efficiency of a tar macadam road and tar painting. 2, Comparison of the efficiency of tar macadam constructed under varying climatic conditions by the mixing method employed at Charlestown, by the penetration method and by the Gladwell system. 3, Economic value of loosening three or four inches of an old macadam road with a scarifier, reshaping the surface and reconstructing the surface with the addition of tar by the penetration method. 4, Methods of increasing the bond between the tar matrix and the sur-

face of an old macadam road. 5, Efficiency of various machines used for spreading tar and special machinery used in the construction of tar macadam roads. 6, Efficiency of roads treated with the various oils on the market, with cold and hot oils, with and without the sand dressing, with and without rolling.

The author firmly believes that in the future more stress should be laid on the economic construction of more permanent macadam roads for highways of the first and second classes and that less attention should be paid to the various surface palliatives.

SUCCESS OF CITY GOVERNMENT IN GREAT BRITAIN.*

By Augustus Lynch Mason, Indianapolis, Ind.

Every one hears of the great success of English cities in the conduct of public affairs. Why is it that they succeed where we fail?

The British city undertakes and carries on many things, which in America are in the hands of individuals. In London, the visitor sees on every hand evidences of great municipal activity. On the Thames river he finds a municipal steamboat line with the letters L. C. C. (London County Council) on every boat and on the docks where it receives and lands passengers. He finds municipal street car lines equipped with perfect cars, operated without any overhead wires, clean, cheap, and frequent in service. He finds numerous public bath houses. He sees public lavatories for men and women, beautifully finished with marble and tile, and equipped with modern plumbing, located under the streets every two or three squares in the principal parts of the city. He finds thousands of model dwellings, built and owned by the county council, and rented at low rates to working men.

Outside of London, it is the same way. Not only in large cities but in very small ones are often to be found municipal street-railway, gas, water, and electric light service. There are municipal piers for steamship landings, municipal parks, pleasure grounds, and concert halls where municipal bands or orchestras render delightful musical programs without charge to the public. We have been told about the municipal street cars of Glasgow and Birmingham, but few of us realize that this extended municipal activity has spread all over England.

How is it that all these complicated business enterprises are conducted by the municipality with honesty and efficiency? What is the secret of this success in the conduct of such extensive public business?

If the city government of Indianapolis owned our street railway lines and operated them, what would be the result? If we may judge by the way our city business has been carried on, we would have extravagance, inefficiency, and corruption throughout its affairs. Take for instance, our experience in the making and repairing of paved streets, the conduct of our city hospital, the disclosures of mismanagement in our city clerk's office in 1903 and 1904, or the scandals concerning the purchase and maintenance of our parks; take almost any other branch of our city business, such even as street cleaning. While these things may be better managed at some times than at others, we find nothing to encourage the belief that a genuine business success is likely to be obtained in the conduct of city affairs.

Let us take the street railroad business, as an illustration of what would probably happen, if Indianapolis were to extend its municipal enterprises in the way which is being followed by progressive British cities. If our city were to engage in the street railroad business, it is safe to say that the purchase of rails and cars, of engines, boilers, dynamos, copper wire, and general supplies would be made at a greater cost than by the corporation now conducting the business. If prices were not padded by dishonest commissions, they would likely be enhanced by political favoritism. The service would suffer, because new cars like our new streets would be allowed to get out of repair as well as dirty. If the tracks become as rough as our streets sometimes do, it ought not to surprise us. Our municipal motormen and conductors would be ward politicians. The pay rolls would contain names of men who were not at work, and perhaps, would work no more. These political motormen and conductors would have so much influence in electing mayor and city council, that their superiors would be afraid to discharge them if they were found negligent, dishonest, or drunk while on duty. They would combine to get laws through the legislature giving them life pensions at half

*From the Indianapolis Commercial Club Monthly.

pay, after twenty years' service, similar to our police and fire pensions. They would secure the passage of ordinances increasing their pay, or reducing the hours of work. In a word, the expenses of operation would steadily increase under public management. On the other hand, the people would demand lower street car fares and would be able to bring such pressure on the council and legislature that few, if any, members could resist it. Thus, with increased expenses on the one hand and decreased income on the other, the great profit which the city ought to make out of the street car business would disappear, and perhaps, be actually replaced by a deficit.

For this conclusion, we have an authoritative judgment of one of the greatest and most experienced advocates of municipal ownership. A year or two ago, the city of Chicago was considering the matter of taikng over all street car lines and operating them as a public enterprise. In the midst of a furious campaign, the advocates of city ownership induced the manager of the noted street railroad lines, owned and operated by the city of Glasgow, Scotland, to come to Chicago and address the people on the subject. He came and made a careful examination of affairs, paying particular attention to the effect of our political system upon the proposed enterprise. He was an honest and very able Scotchman. To the disappointment of the people who brought him all the way from Scotland, he told Chicago frankly, that municipal ownership of street railways, which succeeds so well in Glasgow, would prove a rank failure in Chicago. His advice was followed by the people, who, by a substantial majority, wisely rejected the program of municipal ownership.

Yet, in theory, municipal ownership has many advantages. The streets belong to the whole people. The business of conducting a street railway is profitable, or ought to be so. Why should not the people have the benefit and profit arising from the use of their streets? Theoretically, this position can not be answered. It would be more just if the whole people benefited by the public ownership of street railroads instead of giving the profit to certain privileged persons and bringing into existence a few great fortunes.

The writer is not advised of the actual profits of the street railroad business in Indianapolis, over and above cost of operation and interest on bonds issued for construction purposes. For illustration, we may suppose it to be $500,000 a year, and as the city continues to grow in population, we may suppose that the annual profit will gradually increase.

If this money were to go into the city treasury, a great deal might be done in a very few years for the benefit of our people. In the first year, we could build a half million dollar fire-proof hospital, where every one could be taken care of during illness. The next year, with another half million dollars, we could build a series of contagious disease hospitals, with each building isolated from the others. The third year, we could improve Riverside Park, so as to make it equal to anything in the United States. In the course of time, we could have splendid public baths and lavatories; we could secure much needed school houses; we could enlarge the public library, and all these things could be done, not only without raising taxes, but with a great decrease in the tax rate. This is no dream. If Indianapolis were located in England, instead of on the banks of White River, it is exactly what would come to pass. As soon as the profit of the electric street-railway business became apparent, English cities engaged in the business on their own account. Last summer, the writer frequently saw these municipal street railways and they equalled, if they did not surpass, what we have here in Indianapolis.

In London, there were no overhead wires, all trollies and cables being under ground. Even in small cities, the size of Terre Haute, of Muncie, the overhead trolley was used only in residential districts, while on business streets, all wires were placed under ground. The cars were constructed with delightful seats on top for riding in the open air, having also the usual inside seats. The fares, ranging from two to six cents or more according to the distance, are really higher than in this country, because wages and the cost of living are much lower than in America, and a dollar goes, perhaps, twice as far as with us. One excellent interurban street railroad is owned by the city of Bournemouth. It connects a number of towns on the south coast of England.

These city railroads are built by issues of bonds, bearing, perhaps, four or five per cent interest. After paying the operating expenses the earnings are applied, first, to interest on the bonds; second, to a sinking fund to pay off a part of the bonded debt every year; third, to a fund for repairs, replacements and extensions. When all these expenses are met, there still remains a handsome profit which is applied to the general expenses of the city, thus reducing taxation, and at the same time helping to maintain streets and parks, police and fire departments, hospitals, municipal orchestras, public baths, and other public comforts.

Would it not be a splendid thing, if we

could do this here in Indianapolis? We see the tax rate climbing every year. Each increase of the tax rate means a decrease in the number of men who can afford to own their own homes. It means a decline in the standard of living, on the part of the families of laboring men. Add five cents to the annual tax rate and we push the poor man farther away from the rich man. In spite of the growing tax rate there is also a constant increase of the public debt. Every few months there is a sale of bonds by the county, or a sale of bonds by the school commissioners, or a sale by the city. We are mortgaging the future to provide for the present. What a blessing it would be, if instead of piling this mountain of taxation and of public debt upon the backs of the people, we were to have the profits of the street railway business with which to partly meet public expenses.

However, as was said at the outset, municipal ownership would fail right here in Indianapolis. None of the good things, which English cities get out of it would be realized here. This brings us back to the question, why is it that they succeed where we fail?

The manager of a municipal street railroad in England is chosen by the city council. If we were to visit such council in session in an English city, we would find that it is composed of the most prominent and successful business men of the place. They are merchants, manufacturers, lawyers, and even members of the nobility. There will be found some laboring men of the very highest class, such as foremen and mill superintendents. it is not unlikely that this superiority, in character, and ability of councilmen in English cities, will appear to many persons to be the cause of their success in handling public business. If this be true, then all we would have to do in Indianapolis to make a success of our city government, and do some or all of the things which our English cousins do so well, would be to elect our best citizens to office. This is a thing to be greatly desired, and a moral obligation to aid in its accomplishment rests on every voter. But this article need not have been written, if such a threadbare conclusion were the writer's object. The secret of success in English cities lies very much deeper than the mere statement, that their officials are men of superior qualifications. Better officials, of course, give better government.

Why is it that the men who compose the government of British cities are of so much higher character and ability, than the men who control Indianapolis? Is it because Englishmen average higher than Americans in point of business ability, and of moral character? Certainly not. There is degradation, ignorance, and vice among the masses composing the population of British cities, which is unknown in America. We think we have an evil of some magnitude in the saloon, but no one who looks at the wretched crowd of men, women, and children drinking together at a London bar can deny that the drink evil in England is many times worse than here.

Is it then because national party politics are kept out of city elections in England? This, indeed, may have something to do with it, but it is by no means the real secret for which we are searching.

Is it because high class Englishmen are more willing to give their attention to public matters than the best American business men? This is undoubtedly true. Yet it is not the final answer. We know very well that the city government of Indianapolis can be supplied with the very best men of the city, if the people call on them to take office. They would serve as councilmen and members of boards, but they will not seek to do so.

The secret of the British city's success is to be found not merely in the character of the councilmen, but in the character of the men who elect councilmen. No one votes in a British city who is not a tax payer. A British city is the tax payer's city, and that is the secret of its success in business matters. But the tax payers are very different in number and character from the people who are tax payers in Indianapolis.

There is no tax on land. Buildings only are taxed, and this tax is not paid by the owner. It is paid by the person who occupies the building. Hence, it is that every man who rents a house, or store, or office, or flat, or room in an English city must not only pay his rent to the landlord, but pay to the city the tax on the place which he rents. The result is, that a very much larger proportion of people are tax payers in an English city than is the case here. The man or woman, who pays an annual rent of fifty dollars a year for a house, or lodging, a shop, or office, and who has occupied that place for one year and has paid the taxes thereon is entitled to vote. The tax payer in an English city, directly and immediately, feels the burden of taxation. If the tax rate goes up, an average tax payer, in an English city, knows that the children must go without shoes. If it goes down, he knows he can deposit something in the savings bank for a rainy day. He is, therefore, deeply interested in choosing the best business men to act as members of the city council. He is careful to pick honest and able councilmen. He thinks about it; he is anxious

and interested that councilmen should be able to give efficient management to city affairs. He knows that there is a large profit in the street-railroad business, and that if the city owns the street railroads, and manages them well, the annual profit will help him, will, in part, lighten the load of taxation which he must carry. He is, therefore, really a stockholder in the street railroad. If he sees a conductor steal a fare, he is on the alert to report the thief to the manager, and secure his punishment. If the cars are dirty, or if they fail to stop at proper places, no one is so quick to report these wrongs, and secure redress as the British taxpayer.

We now begin to see why the street railroad, owned by a municipality, is a success in England. There is no danger of any outcry for reduced fares so that the profit will be cut out of the business. The tax paying voters want that profit and need it, and will see that fares are kept at a profitable figure. There is no danger lest politicians in the council order unprofitable extensions of the street railway to be built in thinly populated suburbs, nor is there danger lest the council order an excessive number of cars to be run at a loss, in order to make jobs for ward workers. They have no trouble about demands for unreasonable increases in the wages of motormen and conductors. The tax payers know what is fair and just. They are, for the most part, laboring men themselves, and they will not submit to excessive wages of street car men to their own injury and loss, through an increase of the tax rates. It should be added that employees of the city have no right to vote, and therefore, can not capture the city government and use it for their own benefit.

Let us turn now to our own city. Perhaps, only one-third of our voters are taxpayers, and many of them are too well off, or too busy to take any active interest in public affairs. We have in this city an immense number of voters, colored and white, who feel no concern in the honesty, economy, or efficiency of city government. The candidate, who is able and willing to spend money, can nearly always get a sufficient number of the most irresponsible voters to carry the primaries, and nominate him. An enormous proportion of our voters do not try to discriminate as to the honesty, or the business ability of candidates for city offices. A loud voice, a sturdy physique, an aptitude for stump speaking, friendly relations with the breweries, and other corporations having interests to be subserved by the city government are the qualities which often make a man successful in city politics. Many of our voters are unable to, and really do not, discriminate between the business merits of candidates for city offices.

The lesson, therefore, which we are to learn, is that our city government will do what it has to do rather expensively. It will, on the whole, show extravagance, dishonesty, and business incompetence. Therefore, the more we give the city to do the more we will suffer. So far from increasing the functions of our local government, we must steadily set our faces against everything which will enlarge the plunder fund.

While we can not, in the nature of things, have a system of voting such as exists in English cities, it is still possible that some limitation of the suffrage would make an improvement in municipal government. The time has come when honest and candid men are beginning to think of this question. In the government of cities, we find the plague spot of republican institutions. State and Nation have the benefit of the country vote, which overcomes the slum vote of the city. At the municipal elections there is no such corrective. Hence, it is that recent writers are beginning to suggest a limitation of the suffrage at city elections.

A college president recently said to me, "Indianapolis is the finest specimen of the truly American city that I know of. Yet," said he, "I see the signs of trouble ahead. You have pouring into your city, a constant stream of illiteracy. It is the foreign immigrant who has demoralized city government in Boston and New York, in Philadelphia and Chicago. The day is coming when the native character of Indianapolis will undergo a radical change by the introduction of new and inferior population from foreign countries to say nothing of your continuous immigration from southern states."

The question is, has the democratic theory of universal suffrage no exception? Is it treason to suggest a limitation of suffrage at city elections, designed to prevent ignorance and incompetence from swamping the intelligent and conscientious vote? Is city government to continue increasingly a prize for those men who can most successfully organize the irresponsible and unfit vote, and by methods best known to themselves, capture nominations and elections through the control of such vote?

PHENOMENA OF THE CRUSHING OF SEWER CONDUITS.*

By James N. Hazlehurst, C. E., Atlanta, Ga.

During the year 1894 the writer's experience with the breaking and failure of sewer pipe commenced, when as superintending engineer for a contracting firm constructing some forty miles of sanitary sewers in a southern city, he was required to remove and relay a line of 24-inch double-strength pipe, laid at an average of 15.5 feet, through clay soil, with trench foundations considerably "mucked" and saturated.

There was no collapse of any of these sections, but an internal inspection revealed the fact that many of them had cracked, and, after uncovering, they were found generally quartered, 150 feet in one continuous length being so discovered. Along the sides and under the haunches, extending up about six inches, in a monolithic line, concrete wedges had been required; and the damage was attributed to the rigid support, pivoting the pipe lengths, to the general character of the sub-foundation, and to the weight of the saturated clay used in refilling, although in the light of subsequent experience the correctness of this hypothesis may be questioned.

Four years later, as chief engineer of the municipal improvements at Tampa, Florida, consisting of a considerable amount of paving and the construction of some thirty miles of sanitary sewers, the writer was again called unon to investigate the breakage of a large amount of vitrified sewer pipe under rather peculiar conditions.

The design of this system had been made by Col. Geo. E. Waring, who had also furnished plans and specifications for similar work for the cities of Brunswick and Savannah, Georgia, shortly before, the former having been completed and the latter being then under construction.

At both of these places serious defects had been reported in the sewer lines of from 18 inches to 30 inches in diameter, requiring the removal and replacement of very considerable quantities of pipe, in some instances the substitution being made with cast iron pipe of similar diameters.

After a careful study of the proposed plans and specifications, and prior to advertising for proposals at Tampa, because of his past experience and the knowledge of the situation both at Savannah and Brunswick, the writer deemed it expedient to lay these matters before his board of public works, and recommend to them a change of specifications which would include the substitution of cast iron pipe mains for the heaviest work, which averaged some 14 feet for several miles.

Owing to the increased expense the board declined to permit this, and even refused to allow a change from the standard thickness to the so-called double-strength vitrified sewer pipe.

Protecting himself against personal and professional liability for work done under these conditions through insistence that full record of that meeting be made, the writer advertised the work and commenced active operations shortly thereafter.

At that time the Florida state board of health was rigorous in its insistence that all work of underground construction should be strictly limited to the winter months and that no work of this character should be permited from June 1st to October 1st of each year, under the supposition that malaria and yellow fever might be attributed to miasmatic emanations from freshly turned earth, so that, within the limits stated, all work was suspended.

As is usual, the outfall sewers were those first commenced, and these were laid in a sandy, saturated soil of the usual coastal type, continuous sheathing and bracing being required, and timber foundation generally used; and at the close of the season all lines were securely protected by bulkheads and otherwise.

With resumption of work the lines were opened and drained by pumping, when, to the dismay of the entire staff, many of the sewers were found running full-bore with abnormal infiltration of ground water.

Upon uncovering and stripping, long stretches of the larger mains were discovered to have broken in longitudinal slabs, falling apart as the work was opened up.

These facts being duly reported, after a lengthy negotiation with the contractors, removal and replacement of the damaged sections was agreed upon and executed, cast iron pipe, as originally suggested, taking the place of the standard vitrified material.

The exact figures of quantities and costs are not at hand, but the increased expense was extreme, since the contractors took advantage of the situation to demand prices out of proportion to what they would have charged under original bids,

*Extract from a paper before the American Society of Municipal Improvements.

the change being so radical as to destroy the value of the first contract, which, it is fair to say, had been a losing one to the contractors, and very considerably below the cost estimate of the writer.

In connection with a piece of work differing in nearly every respect from the conditions cited, but with large damage primarily attributable to the failure of the vitrified pipe of the larger sizes, the writer has very recently been retained by a contracting firm to determine, if possible, the cause of the trouble, and to make proper presentation of their side of the controversy, and this late investigation is largely responsible for the presentation of this article.

The work mentioned included several contracts aggregating $114,500.00 in an important southern city where all work had been completed according to the contract terms, and, being ready for acceptance, a final inspection revealed the following lengths of damaged pipe:

70 feet of 15-inch sewer,
450 feet of 18-inch sewer,
115 feet of 20-inch sewer,
560 feet of 22-inch sewer,
1,076 feet of 24-inch sewer,

or a total of 2,251 lineal feet of sewer from 15-inch to 24-inch in diameter; the loss entailed in replacing this pipe approximating $7,000.

The city engineer maintained that as the specifications called for the "best quality of vitrified clay pipe," this material having failed under the conditions to which it was subjected, was manifestly of inferior quality, and he required that this be replaced with suitable material at the contractors' expense.

Tests made of this material both by the writer and the manufacturers showed this pipe to have been of good average quality, and capable of resisting far greater loads than those applied under actual conditions, the maximum depth under which the pipe failed being 23 feet, while the greatest damage appeared in trenches of insignificant cover.

The trenches in which these sewers were laid were cut in a firm, clay soil, the walls standing at the perpendicular without sheathing or bracing, the foundations being entirely free from ground water, and under these ideal conditions, of 4,234 feet of 24-inch pipe laid, practically one-quarter was damaged as stated, and had to be removed.

By elimination, the theory of this damage advanced by the writer and maintained by the contractors was that the cover required over the top of the pipe was insufficient for proper protection, since only six inches of loose earth was permitted above the barrel of the pipe before ramming was required, the tool used being specified to weight not less than 40 pounds, with an 8-inch square face. With this implement, the loose earth readily compacted to 4 inches, leaving only 2 inches above the bell of the 24-inch pipes, where exact depths of cover had been secured.

That the engineer was himself at least suspicious that the damage arose through the light cover specified, in connection with the unusual ramming implement, was shown by a change in the requirements for a subsequent contract to the same firm, and in which he reduced the weight of the tool to 30 pounds and increased the depth over the pipe before ramming to 12 inches. Under the new conditions, upon final inspection, not a single joint of pipe was found to have failed.

Under these contracts the engineer had been most insistent upon the thoroughness of refilling and ramming, and his entire staff was repeatedly cautioned and instructed to demand a most unusual thoroughness in the matter of refilling, the effort being to replace all excavated material after pipe laying.

In an instructive paper read by Mr. Alexander Potter before the Boston Society of Civil Engineers, referring to the failure of pipe sewers in the Orange, New Jersey, works, the salient features are:

(1) Observed failure after rain storms.
(2) Failures limited to rock trenches.
(3) Shallow depths where failures occurred.
(4) Phenomenon of failure by quartering.
(5) Transmission of rupturing stress from joint to joint.

Considering these items in reversed order, 5, 4 and 3 are conditions generally found, in the writer's experience, to prevail; but in his own work, failure was not limited to rock trenches, but, to the contrary, most generally occurred in trenches of quicksand and unstable sub-foundations, as was referred to in the Tampa experience before alluded to; although in the damage case mentioned, a considerable portion of the pipe had failed in rock cuts, and, in the writer's opinion, the failure of pipe under such conditions may be attributed to the shock or tremor caused by blasting even a considerable distance in advance of pipe laying, the susceptibility of the vitrified pipe to this being well known, and in this connection the following, if not substantiative, is at least suggestive:

A year or more ago the Jefferson County Sewerage Commission, Mr. Julian Kendrick, chief engineer, had completed a section of their work near Birmingham, Alabama, when there occurred an explosion of a magazine containing dynamite, and about a quarter of a mile from the

work, following which an examination of several thousand feet of 24-inch vitrified pipe sewer revealed the fact that it had been shattered to an extent making it necessary to entirely relay. Without following this incident further, but returning to item 1, i. e., "Observed failure after rainstorms," the writer's own experience closely follows that of Mr. Potter's and an hypothesis accounting for this phenomenon injects another element into the problem, since failure may have occurred after a rain of such light fall and duration as to preclude the reasonable conjecture that it might be the product of saturation and additional weight.

Physical tests upon clays used in the production of sewer pipes are conspicuously lacking, although experiments have been made upon homogenous materials, manufactured into paving brick and fire brick, by the national and private testing laboratories.

The average of such tests at the government Watertown Arsenal, gives 1,300 pounds as the modulous of rupture, while from tests made by the writer upon sewer pipe material vitrified, R was found to be 1,368 pounds.

This constant varies naturally with the different clays and degrees of heat to which it has been subjected, but in attempting to use this factor for the solution of practical problems, we are confronted with the fact that so far as the writer is aware, no satisfactory hypothesis has been established promising rational results.

If we analyze the stresses for a 24-inch diameter sewer pipe, with shell of 2 inches, and consider the load as uniformly distributed upon a beam with span equal to the diameter, with maximum fiber stress assumed as 1,300, and the weight of a cubic foot of earth as 100 pounds, we find a fill of 36.1 feet as the extreme load tending to produce rupture.

Considering these stresses as applied to a ring instead of to a beam, and assuming with Rankine that "the thrust round a circular ring under an uniform normal pressure is the product of the pressure on an unit of circumference by the radius," and using a factor of safety of 5, the safe load for a 24-inch pipe is found to be 31.2 feet.

Sewer pipe when jointed and laid in continuous lines are certainly neither beams nor rings; but only tentative methods, considering the continuous cylinder, have been advanced by writers on structural mechanics.

It is unquestionably a fact that if careful investigation were made of pipe sewers of the larger sizes, an enormous amount of pipe would be found cracked, and it is only when a pipe is so badly broken as to collapse, that official attention is given and repairs insisted upon.

On account of susceptibility to shock rather than the limiting depth of filling, the practice of using clay culvert pipe, once so common, has largely been abandoned by the railway companies of this country, the tendency being toward cast iron pipes for this service, and from the same objection, these in turn have been generally discarded for concrete construction of varying types.

The writer is of the firm belief that under normal conditions the use of unprotected vitrified clay pipes should be limited to and including 15-inch diameters; that beyond and including 24-inch, standard sewer pipe incased in a lean concrete up to spring line and then beveled off at 45 degrees, is good construction; that reinforced concrete pipe of 27, 30 and 33 inches can be economically manufactured, preferably on the line of the works, and should be used, while 36-inch and larger sizes should be of brick of continuous concrete construction, depending upon soil, labor, available materials and other limiting conditions.

With the smaller sizes of vitrified sewer pipe far greater attention should be given toward securing an impervious connection, with experimental effort toward an elastic, permanent and non-rigid joint composition, with full understanding that the more careful work, while necessarily augmenting the cost, in the final analysis would permit safe estimating while the elimination of the element of ground water to be provided for would more than compensate for increased unit prices.

EDITORIAL COMMENT

Architectural Expression in Concrete.

The Terms of a Water Works Franchise.

ARCHITECTURAL EXPRESSION IN CONCRETE.

The problems of the architect who proposes to use reinforced concrete are considered in a carefully worked out paper by H. Toler Booraem, in *The Architectural Record*. He has restricted his consideration to reinforced concrete as the most important application of concrete to building, and dismisses other methods of use of concrete in structures by including them with reinforced concrete or ruling them out on esthetic grounds.

Concrete has forced its way into building construction by way of the practical builder by virtue of its economy and strength, and has reached its height through the technical ability of the engineers who have recognized its paramount value as a building material. Until the last two years it has received only sporadic recognition from architects for its value as a medium through which to express ideas of beauty of structures as well as utility and economy. This is natural, and can scarcely subject the architects to censure, although there has been consequent delay in the development of the new building material, and there are many atrocities which have been perpetrated by builders and by engineers who lacked the artistic sense and training which are essentials for a good architect.

It is apparent from Mr. Booraem's article that he is by no means certain of the position of concrete in the artistic requirements of architecture, and he acknowledges that the new architecture in which concrete will be the ruling feature, and which will be adapted to its peculiarities, has not yet shown itself. The present studies of the subject have shown and are still showing what not to do rather than what can or should be done.

Thus imitation of styles of architecture suited to other materials is not advised except so far as the motives and effects approximate those peculiar to concrete. Both Mr. Booraem and Mr. Pond, the latter in the article on "Treatment of Concrete Surfaces," on page 224 of the April number of MUNICIPAL ENGINEERING, condemn the concrete block as a base imitation of stone, and therefore not acceptable for an architectural composition. It seems to the writer that both these noted architects are incorrect in their position on this matter, if their own statements of the basis of their opinions is accepted. A rock-faced concrete block is a barefaced imitation of a natural product which cannot be successfully imitated and is properly condemned, but there are facts about concrete construction which justify, and, in fact, may demand, the use of concrete in block form, and one of the basic principles laid down by these gentlemen is that a building which is successful architecturally must tell the truth. The truth about concrete is that in large surfaces cracks are probable on account of expansion and contraction from changes in temperature. If these cracks are not localized by joints, they will give trouble by appearing where they will be unsightly. The builders of small buildings may not be able to provide the necessary materials for producing monolithic concrete; it may be necessary to make up the concrete at one place and put it into a structure at another. Conditions of economy and expediency, and often of necessity, therefore require block construction. In many cases therefore blocks frankly admitting their concrete structure are, by the principles governing these gentlemen, proper architectural material and must be accepted as such. Because blocks bad in design and poor in quality are on the market is no reason for condemning good blocks standing on their own merits as an architectural medium. There is apparently a place for the concrete block in both large and small buildings. Is a concrete block veneer for a reinforced concrete wall any less true than a brick or stone veneer? At least during the period intervening before a true concrete architecture appears there is a place for the concrete block as well as for brick and stone in combination with concrete, and not always as a "matter of finish to imitate something else."

Mr. Booraem considers concrete as not only plastic, but monolithic, and that the indication of joints is illogical. This is true only in part, for in some designs the establishment of joints is essential and therefore not illogical, while in others the danger of cracks is reduced to a minimum and joints are not necessary structurally, and therefore not necessary as an architectural feature. A complete view of the

problem must not ignore the location of joints altogether.

That the architectural treatment of concrete surfaces is in a very chaotic state is evident from Mr. Booraem's article. Thus far there have been but few departures from imitative forms of earlier decorations in plastic materials and from veneers of other materials. The possibilities of variety and of style in the formation of designs on the plastic surfaces and in them, of color, of insertion of ornamental designs in other materials and of characteristic combinations of veneers of various materials, are infinite, and when some genius among the architects has opened a way there will be an expansion in this direction as rapid as that in artistic treatment of public grounds and buildings following the Chicago World's Fair.

The suggestion that development be made slowly and with continual slight variations from conventional styles is good so long as there is no one with, at the same time, true courage and artistic genius enough to break away entirely and bring forth a new style exactly fitted to the new material. The time is not quite ripe for this departure, but a very few years of experience will develop the Moses. He is likely to be an American, and the new concrete architecture is likely to be the American architecture for which we are all looking and have been hoping to find in the tall buildings. Concrete is a more nearly universal medium of expression, and is therefore a better basis for a national architecture than a special business building, which can at best show itself only in the larger cities and be applied only to special uses.

THE TERMS OF A WATER WORKS FRANCHISE.

The Engineers' Club of St. Louis recently discussed the subject of the appraisal and depreciation of water works, opening with a paper by William H. Bryan and continuing with contributions by Robert Moore, Edward Flad and S. Bent Russell, all well fitted to speak, on account of education and experience.

Mr. Flad presented a skeleton of a franchise, the adoption of which he thought would render municipal purchase and the consequent valuation of the works comparatively easy. The others did not agree very closely with him, but it seems to the writer that all those engaged in the discussion were upon a wrong basis, and that the many practical difficulties which arise in the relations between public service corporations and municipalities, especially when it is proposed to close them by taking over the plant, can be overcome by putting the partnership idea, put forward by Mr. Russell, upon a proper basis.

Perhaps partnership is not the proper term to use; it certainly does not express the relationship exactly, but the word contains part of the idea, for it expresses the community of interest, which should be a fundamental principle in formulating the relations between the contracting parties.

A water works plant, or any public service industry which is essentially monopolistic, is in reality public property, whatever form the technical evidence of ownership may take. It may be operated by a contractor, under terms requiring him to construct the plant as well as operate it, and it may be necessary for the city to reimburse him for his outlay before it can obtain technical ownership, but much of the growth of the plant is due to the growth of the city and all the recent valuations of plants have accepted, more or less completely, the theory that the value of this part of the development should accrue to the city. Undoubtedly a considerable portion of the growth of the plant may be due to the efforts of the company to extend its business. Every case has its own condition. In one the company may sit quietly and take the increment which comes naturally, in which case it would be entitled to no consideration for "going value." In another all the increment may be due to the efforts of the company, the growth of the city being slight or offset by special local conditions, in which case the company would be entitled to full credit for producing the "going value" of the concern. Any individual case would doubtless lie between these two extremes, and therefore the increment should be divided between the two parties to the contract, and therein lies the principal analogy to a partnership.

Under the American methods of letting franchises and giving up a large part of the control of the corporations holding them, it is difficult to determine how the increase in value should be distributed. The English method is better, because the matter is adjusted automatically. In case a new franchise is granted a careful study is made by experts and rates are fixed which will probably give a certain percentage of return on the capital actually invested, under the conditions actually existing, or, in case of a new plant, under the conditions as they are expected to develop within a reasonably short time after the plant is completed. These rates are, presumably, so fixed as to be sure to produce the required return. Then, as business develops, a surplus gathers in the treasury, after making all allowances for depreciation, sinking fund or whatever name the fund may bear. This surplus is divided between the company and the pa-

trons of the plant by a very simple rule, which provides that for every reduction of a certain number of cents in the rate charged for service the company shall be entitled to an increase in its dividend rate of one per cent. The exact rates and relations of changes are fixed for each case according to the local conditions.

The result of this partnership is a desire on the part of both company and patrons to increase the business of the company, since both profit by this increase, and there is less desire for municipal ownership because all are working for the good of the business and all have equal interest in its extension and in its economical management.

If meters are in use for all services, the change in rate is easily made. If they are not, they must be modified in such a way as to make a uniform percentage of decrease of total payments of all consumers, as nearly as possible, and produce the reduction in income necessary to take off the consumers' share of the surplus.

The proposition in Mr. Flad's form of franchise to issue 50 per cent. of water would not be tolerated under an English franchise. To be sure, the stock issued is intended to give control of the company to the bondholders, or the bonds are sold to the stockholders to give them more complete control of the property in time of trouble, but another clause in the proposed franchise would recognize this water to the extent of paying 4 per cent. interest on it, cumulative, thus making the return on the capital invested 10 per cent. before any allowance is made for sinking fund or anything is set aside for repairs, improvements or extensions.

Four per cent. is nearer the interest allowed upon English capital invested in public service corporations, and that only after the depreciation or sinking fund is taken care of, and as the contracts with the municipalities make the capital practically safe, it is not difficult to find the funds necessary for such enterprises.

Should the city really desire to purchase a plant operated under a franchise so favorable to it as well as to the company, it may be considered that the company has received each year the benefit of its own efforts as well as those of its partners—that is, patrons—and its capital represents the value of the concern as a business concern, so that the payment to the stockholders of the market value of their stock would make the transfer of ownership simply, easily, and with justice to all.

The trouble with the valuation of American franchises is that the companies may have been receiving more than their fair share of the profits of the business, which is not all theirs, but in part belongs to the public, and their capitalizations do not represent their cost, and it is usually impossible to get into the financial history of the company far enough to ascertain the actual value and the return thereon actually due, so that the approximations indicated by the various methods listed by Mr. Bryan must be made, one being chosen for each case which seems to fit it most nearly, so far as the meager information obtainable will allow the formation of a judgment.

When new and renewal franchises are under consideration it will be worth while to incorporate a provision similar to the one above considered, and it will be found advantageous to both parties.

THE QUESTION DEPARTMENT

Effect of Oil on Concrete.

The New York Fire Board and fire boards in other large cities have rules compelling the use of ten to twelve inches Portland cement concrete in connection with underground storage tanks for gasoline.

You are no doubt aware that gasoline, especially for the automobile, is generally stored in underground tanks and drawn from same with self-measuring pumps.

We manufacture oil pumps and tanks and the question of imbedding the tank in concrete is one that we desire to thoroughly investigate.

We inclose copy of an article taken from the publication, *Pumps and Supplies*, published at 65 Fulton street, Chicago, issue of October, 1907, from which you will note that it is stated that oil, for some reason, has a tendency to rot cement, mortar and concrete.

We have noticed that the concrete and cement foundations of large capacity oil storage tanks used by the Standard Oil

Company and other oil companies, and placed above the ground, have a decided tendency to rot and decay.

Our purpose in taking up this question with you is to ascertain if you can advise us definitely whether or not oil, and especially gasoline, would have a tendency to seep through ten to twelve inches of concrete.

The rule of the New York Fire Board compelling the use of concrete is for the purpose of preventing gasoline from running into the cellar of a building in case the underground oil tank should spring a leak.

We would infer from our observation and from the article referred to, that concrete would not answer the purpose and that the oil, in case the tank should leak, would in time work through the concrete. Can you say definitely that such would be the case? T. M. CO., Cedar Rapids, Ia.

Following is the article referred to:

Concrete, as generally understood, is composed of Portland or natural cement, mixed with coarse sand and an aggregate. This aggregate may be broken stone, broken brick, gravel, furnace cinders, etc. These three materials are mixed together with a certain amount of water. The quality of the concrete depends upon the quality and quantity of the cement, sand and the aggregate, as well as the manner in which they are put together, also the quantity of water used in mixing. Cement will utilize only a certain quantity of water. Anything over and above this quantity is discarded by cement and goes to waste. When this surplus has disappeared there are minute spaces left in the mortar, which in time are filled by some other material. When the concrete is made too wet, then the tendency of the three materials is to separate, the heaviest going to the bottom and the lighter ones rise to the top and often run away, often taking with them a certain quantity of cement in solution.

Chemists tell us that the cements carry a very large per cent. of the alkali lime, being something over 6 per cent. in the best Portlands, there being several other ingredients besides, this lime in all cements being the cementing agent, in fact its very life, and anything absorbing or neutralizing this lime very materially impairs the strength of the concrete. The crushed limestone which is used in Chicago so largely for concrete has a larger per cent. of lime than the cement used. Some of the limestones have as high as 95 per cent. of carbonate of lime in their composition. Consequently a limestone concrete has in its make-up a very large per cent. of lime.

Soap is a compound of alkalies and oils put together for use in washing. The oils used are almost altogether vegetable and animal. The mineral, it seems, does not have the affinity for the alkali of the others. Oils of all kinds have a greater capacity for penetrating solids than water. Now, then, it would seem to be very reasonable that animal or vegetable oils coming in contact with concrete having such a large per cent. of lime, and the power of penetration which the oils have, that a crude kind of soap is made slowly—but very slowly—for the affinity which oil and alkali have, one for the other, will surely take place when they come in contact.

It has been the testimony of parties that oil, for some reason, has a tendency to rot cement, mortar and concrete, and it stands to reason that this rotting complained of is simply the formation of a soap composed of lime and oil. The power of penetration which oil has will gradually fill up the minute cavities occupied by the water, when a surplus was used in concrete mixing.

There is a point to consider at the time of designing concrete buildings, if they are to be used for manufacturing oils, or where large quantities of oil are to be used, with a possibility of the oils coming in contact with the concrete. It seems in course of time a collapse might take place from some unaccountable reason.

In MUNICIPAL ENGINEERING, vol. xxix, p. 351, will be found a statement of conclusions from tests of the effect of various oils upon concrete, made by J. C. Hain and by M. Toch. Prof. R. C. Carpenter presented a paper on the subject before the last convention of the American Society for Testing Materials. The conclusions from the three sources are that mineral oil, petroleum, does not disintegrate the concrete, but soaks into it and affects the strength somewhat. Engine oil has a sensible weakening effect. Animal fats and oils of various kinds disintegrate concrete. In general, therefore, mineral oils do not disintegrate concrete, the vegetable oils tested have little or no effect, and animal oils do affect the concrete. All oils are absorbed by concrete, and apparently all of them reduce the strength of the concrete to a greater or less extent.

As to oil seeping through concrete, it is probably true that non-drying oils, especially if of low specific gravity, will find their way through concrete more readily than will water, and the rate of seepage will depend on the porosity of the concrete. It is very difficult to make a mass of concrete absolutely water-tight without some sort of plaster on the surface, but if this result is secured the concrete is probably also oil-tight, unless the oil attacks the concrete, as it will if an animal oil, and removes the water-tight coat. Probably the best underground tank would be one of steel, lined inside and out with concrete. The steel tank should be oil-tight and the concrete would preserve it from corrosion. The combination should be stable underground, where temperature changes are slight, unless there are sudden changes on account of variations in temperatures of oil fed into the tank.

Stability of a Column Capital.

I would be glad to have your opinion of the design and construction described below. In a college library building, mostly concrete, to cost about $40,000, there are four large columns of solid concrete at the main entrance to building. Columns are 25 feet high, 2 feet 6 inches diameter at top, surmounted by "staff" capitals. Each capital is cast in four sections, weighing about 50 pounds each, or 200 pounds for each capital. These capitals are fastened to the column by drilling four holes in each column, about one foot below the top, in each of which holes is driven a wooden plug about one inch diameter. To these plugs is nailed a square wooden frame made of four pieces of 2 by 4-inch, surrounding the concrete

column. To this wooden frame is nailed the staff capital. In driving the nails into the staff the latter was cracked in a number of places. The wooden frames of 2x4-inch stuff surrounding the columns are nailed together at the corners. Is this construction good practice?

E. S., Claremont, Cal.

This question is referred to our readers for statement of its conformity with their practice. If the description is correctly understood, the shear on the nail driven into each of the wooden pins is about 50 pounds. If there is no other support than the frame and these nails, there is little margin of stability and safety in the structure carrying the capital.

Boulevards in Small Cities.

I am interested in a movement in Petersburg, Va., to open up a broad boulevard from the center of the city into the outlying districts.

I desire to secure such back numbers of your magazine as may treat specifically of what other cities are doing in this line.

The work in large cities will not interest us as will the work in smaller towns. The knowledge of what other towns of from 25,000 to 100,000 are doing in the way of beautification will tend to stimulate our conservative body of law-makers.

J. W. H., Petersburg, Va.

The descriptive articles on boulevards in MUNICIPAL ENGINEERING happen most of them to be concerning those in large cities. The following give more or less information on the subject:

"Plans for Boulevards," vol. ix, p. 38.

"Essential Features of a Park System," vol. x, p. 167.

"Ornamental Boulevards in the United States," vol. xxiv, p. 34.

"Parkways and Boulevards for Philadelphia, Pa.," vol. xxiv, p. 167.

The following cities are more or less interested in this question and can furnish information by letter, if not in printed form, on application to the person or organization named:

Minneapolis, Minn., Minneapolis Real Estate Board.

Washington, D. C., American Institute of Architects.

Harrisburg, Pa., J. Horace McFarland.

Cleveland, O., City Hall Commissioners.

Buffalo, N. Y.

St. Louis, Mo., Civic League.

Detroit, Mich.

San Francisco, Cal., Merchants' Association.

Baltimore, Md.

Philadelphia, Pa.

Colorado Springs, Colo.

Columbus, O.

Syracuse, N. Y.

Columbia, S. C., Civic League.

Denver, Colo., Art Commission.

Oakland, Cal., Mayor.

St. Paul, Minn.

Kansas City, Mo., Geo. E. Kessler.

Duluth, Minn.

Hartford, Conn., City Engineer.

Indianapolis, Ind., Municipal Art Association.

New York City, Municipal Art Association.

Los Angeles, Cal.

Springfield, Mass., Mayor.

Pittsburg, Pa., Pittsburg Chapter of American Institute of Architects.

Ogdensburg, N. Y.

New Orleans, La., Progressive Union.

Atlantic City, N. J.

Boston, Mass., City Club.

Watertown, N. Y.

Greenville, S. C., Municipal League.

Methods and Cost of Street Cleaning.

Can you give me any information or references to sources of information touching the relative value of street cleaning by means of the unprotected revolving brush sweepers and machine or hose flushing?

Can you refer me to any authority regarding the sanitary dangers in street dust?

Any help you can give relative to the above will be useful not only in Nashville, but throughout the South, in connnection with the tuberculosis campaign.

AMERICAN TUBERCULOSIS EXHIBITION, Nashville, Tenn.

The following articles in MUNICIPAL ENGINEERING have direct bearing upon this subject:

"The Street Cleaning Problem," vol. xiii, p. 287.

"Comparative Cost of Street Sweeping by Various Machines," air blast, revolving brush and hand, vol. xxi, p. 41.

"Cost of Cleaning Streets," table with results from many cities, vol. xxii, p. 207.

"Street Cleaning Machines," vol. xxii, p. 301.

"Automatic Street Sweepers," run by man power, vol. xxiii, p. 79.

"Cleaning Asphalt Streets by Flushing," vol. xxv, p. 259.

"Street Cleaning Methods in Washington," vol. xxv, p. 260.

"Garbage Disposal and Street Cleaning," vol. xxxiii, p. 236.

"Cost of Street Cleaning in Washington," vol. xxxiii, p. 260.

"Cleaning Streets by Flushing," vol. xxxiii, p. 318.

"Street Cleaning Apparatus in Dresden, Germany," vol. xxxiii, p. 384.

Cost of Water, Gas and Electric Light.

Will you be kind enough to inform me where I may get a statement, or data to make up a statement, showing the relative cost to the consumer of water, gas and electric light in representative cities of 40,000 to 100,000 population, also cost of city lighting per light?

A. V. H., Charleston, S. C.

The following, among many articles in MUNICIPAL ENGINEERING, will aid in the search for information of our correspondent:

"Water Rates in the Larger Cities of the United States," vol. xvii, p. 264.

"Electrical and Water Rates," vol. xxiii, p. 454.

"Prices of City Electric Lighting," vol. xxiii, p. 175.

"Information about Water Rates," vol. xxv, p. 93.

"Prices Charged for Gas and Electric Light," vol. xxvi, p. 410.

"Meters, Their Use and Benefits," vol. xxvii, p. 119.

"Regulation of Gas and Electric Rates in San Francisco," vol. xxviii, p. 295.

"Fair Basis for Fixing Water Rates for Fire and Domestic Service," vol. xxviii, p. 464.

"Cost of Municipal Lighting in Alameda, Cal.," vol. xxix, p. 27.

"Cost of Decatur, Ill., Lights," vol. xxix, p. 27.

"Information About Electric Lighting for Cities," giving list of articles on this subject in preceding numbers of MUNICIPAL ENGINEERING, vol. xxix, p. 96.

"Minimum Water Meter Rate," vol. xxix, p. 178.

"Systems of Electric Street Lighting," vol. xxix, p. 263.

"Municipal Ownership of Gas Works," vol. xxx, p. 49.

"Cost of Electric Lighting in Cities," vol. xxxi, p. 20.

"Cost of Electric Lights in Large Cities," vol. xxxi, p. 302.

Most of the numbers mentioned can be supplied at 25 cents each.

Book on Cement Uses.

Sirs—I understand that you have an excellent book on cement. Would you kindly send me a catalogue, with prices and the exact title of it, and oblige? My geology instructor recommended it to his class as an excellent reference book on the subject of cement. J. A. S., Bloomington, Ind.

The book referred to is the "Handbook for Cement Users" ($3), which is a compendium of specifications for cement and cement testing, and for mixtures and works in which cement is used, prepared for the practical man, and containing all the best things the engineer and contractor, designing and constructing works in which cement is used, wants close at hand for reference.

How to Apply Paraffine Waterproofing.

As a subscriber of your magazine I take the liberty to ask you if you would give me directions how to use pure paraffine wax. I have tried it, and as soon as I get it away from heat it will commence to set, therefore I have no chance to put it on. I have something important to waterproof that I have tried, and could not get any satisfaction.

G. S., Mitchell, S. D.

The following brief description of the process of waterproofing with paraffine, and statement of the difficulties of applying it, is abstracted from a pamphlet copyrighted by Neal Farnham, C. E.:

A thorough knowledge of the method of heat application is necessary. Experts who have been engaged on the work for fifteen years learn something every day.

The fabric is first heated to 250 degrees by specially arranged apparatus. The pure wax is then applied in melted condition and allowed to absorb, filling every pore of the fabric to a depth of one-eighth inch in marble to one-half inch in the coarser materials. It is then allowed to cool and forms an invisible filler, an integral part, as it were, from the surface into the body. Nothing is left on the surface. Rough work, rear brick walls, concrete and stucco are then completely treated.

When a fine finish is desired, notably on stone, marble or face brick, the surface is then gone over with sand blast to remove all fine particles of the wax from the interstices. Stone facades, marble monuments and mausoleums receiving the treatment are not changed in color and texture, and can easily be kept clean by washing. Details of the process are patented.

The wax can also be applied in the form of a supersaturated solution of the wax, which is painted on and carried into the pores by the solvent liquid, which then evaporates, leaving the wax set.

Model Gas Works Franchise.

I would like to ask you whether the Citizens' Gas Company, of Indianapolis, mentioned in your interesting article in MUNICIPAL ENGINEERING for November, 1905, is now in operation.

Where could I get a copy of the franchise under which it operates? Is the price mentioned, 60 cents, for illuminating or for fuel gas, or does it include both?

H. H. T., St. Louis, Mo.

The Citizens' Gas Company is now in active operation, and after a long siege of litigation has been able to purchase the gas mains of the old Consumers' Gas Trust Company, and its board of directors is now working upon the problem of what method of manufacture to use, and they will probably soon ask for proposals for construction. Sixty cents is the price for gas for all purposes. The franchise requirement is that the calorific power of the gas shall not be less than 600 heat units per cubic foot, and there is no requirement concerning illuminating power. An article upon the subject of the gas company is in contemplation when the company nears a condition of actual manufacture.

Strength of Concrete Wall.

I wish to know the resisting power of cement walls 10 feet high, 12 inches thick at top, 18 inches at bottom, reinforced with ⅝ inch round rods, perpendicularly

8 inches apart, horizontally 12 inches, said wall to be 120 feet long, for impounding water. Would you consider it a safe wall for tank purposes?

F. C. CO., El Paso, Tex.

A wall to resist water pressure in a reservoir must have weight enough so that it will resist the overturning moment exerted by the water, or it must be anchored into the foundation with sufficient strength to have the same result. It must also have weight enough or strong enough connection with the foundation so that the water pressure will not cause it to slide out. Neither of these requirements are shown to have had consideration in the question as asked.

Walls for tanks and small reservoirs, in which the reinforcement runs round the walls continuously and which are circular or approximately so in plan, will be able to withstand the outward pressure if properly designed, by means of their resistance to the tension developed in them, and they will be taken out of the class of walls requiring gravity stability.

Standard Rattlers for Making Brick Abrasion Tests.

An addition to the names of those making standard rattlers for testing paving brick according to the specifications of the National Brick Manufacturers' Association should be made. Tinius Olsen & Co., 500 North Twelfth street, Philadelphia, Pa., make one in which they use rolled steel staves, with ribbed cast-iron end pieces. Charge and shot are placed in the cylinder by removing one stay, held in position by two quick-acting clamps. The cylinder may be made double so that two comparative tests may be made at the same time.

Waterproofing Concrete Block Wall.

Last spring I erected a store of cement blocks, dry process. We used good materials and lots of cement. The blocks are very durable, at least we can hardly chop or chisel them. The building is 24x48 feet, having two 12-foot stories. We built a double wall, the outside blocks being 5 inches thick, 5½ inches high and 23 inches long. Those used for inside wall are 4 inches thick and twice as high as the outside blocks, but same length. The inside blocks are smooth faced and the ones on outside are rock faced.

I have a neat building, and I think a very durable structure, but the blocks absorb water when it rains. The air space between the walls is about 1½ to 2 inches. We used many wire bonds (No. 8 wire). The builders were not careful with mortar and it frequently dropped between the walls, so that moisture is carried through the walls in this way, and water comes through above the windows because the caps are of cement and reach through the wall.

I understand that you recommend a preparation to waterproof such a building. I have March, 1907, copy of MUNICIPAL ENGINEERING and have read the article there about waterproofing cement. Very likely you have something better to offer now.

J. S. L., Cedar Falls, Ia.

The article in MUNICIPAL ENGINEERING for March, 1907, above referred to, describes Sylvester's process, which is also described at somewhat greater length in the "Handbook for Cement Users" ($3). It is still one of the best applications readily made to a wall already constructed, and is reasonably durable. The paraffine process is described elsewhere in this number, and the value of this process is discussed in the January number, vol. xxxiv, page 32. There is another article in the February number, vol. xxxiv, page 97, which names the various processes applicable to a constructed wall and gives references to numerous articles which appeared in MUNICIPAL ENGINEERING during 1906 and 1907. Reference should also be made to the article in the March number, vol. xxxiv, p. 167, for further information. This last article calls attention to the possibility that water on the inner surface of the wall is due to condensation of moisture from the moist atmosphere of a room on a cold outside wall. This is sometimes mistaken for seepage through the wall. Reference may be made to the firms listed each month in the "Business Directory," under the heading "Waterproofing," all the prominent methods, except those open to all users, being represented.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Methods of Making Concrete Poles.

A Canadian firm has been actively engaged in the manufacture and installation of concrete poles for supporting transmission cables for the past five years.

In the matter of design the concrete pole is built to conform to the general idea of all poles. In all lines there is a strain applied on the support that is greatest at the ground line, and decreases toward the top, where the stress is applied. With the decreasing strain it is evident that a smaller section is required than would be necessary were the same strain continued throughout, and to meet this condition use is made of tapered reinforcing. This is composed of rods of decreasing size, welded together, each size being in stock lengths.

The ratio between the area of steel and concrete is kept constant throughout, resulting in a tapering pole, with no unnecessary steel or concrete, and yet amply meeting the required conditions as to strength.

The size of reinforcing rods and the sectional area of the pole are determined by the height of the pole above the ground and the horizontal strain due to cable weight, wind pressure and probable ice coating.

The pole is square, with chamfered corners, and a regular taper from the bottom to the top. The four reinforcing rods are placed one in each corner, as near as possible to the exterior, to allow of sufficient covering of concrete to protect the steel from effects of the weather. Thus two rods are always in tension, taking a strain that the concrete in itself is not able to do.

Poles of large dimensions are made horizontally on the ground, with their butts immediately over the hole in which they are to be erected. Large poles are difficult of transportation, as a 50-foot pole, with a base of 17 inches and a top of 8 inches, weighs nearly 5 tons. However, in the case of trolley poles, it is found that they can be made at one point and afterwards distributed along the line where they are intended for use.

The molds so far used have been of wood, fitted together in sections, with the top left open so that concrete can be smoothed with a trowel. In cases where a large number of poles are to be made there is no doubt that galvanized steel forms could be used to advantage, although the wood forms can be used indefinitely, depending on the care that has been taken of them. In the open top the steel is easily placed, and also, while the concrete is yet soft, climbing steps are placed and all holes or bolts set as required.

The concrete is composed of 1-2-4 of cement, sand and crushed stone, or equal success has been met with by using suitable gravel.

The concrete pole is not absolutely rigid, as is often supposed, but is elastic within a broad enough limit to enable it to withstand all ordinary shock. By the use of tapered reinforcing the strain is not transferred directly to the bottom of the pole, but is distributed over its entire length.

Concrete cross-arms are in use on several lines and are giving every satisfaction.

Another process of making poles has been invented by a German engineer. By this process pipes or hollow poles or posts are made of a thin liquid mass of cement and asbestos, in rotating forms, by means of centrifugal force. Metal reinforcement is inclosed in the concrete. In the form is placed a skeleton frame of iron, about which the asbestos-cement mass sets. Plenty of water is used and the thin liquid is placed in a hollow form which is tightly closed and placed in a horizontal position, and then rotated at the rate of from 300 to 1,500 revolutions per minute. The centrifugal force thus developed throws the material against the form and compresses it. It is distributed evenly, and the water at the same time is forced out. This is continued for from 10 minutes to a quarter of an hour, and the form

is then opened and the surplus water drawn off. The pipe is allowed to remain a few days in the form, and then removed.

Telegraph, signal and transmission line poles of all kinds, pipes, columns and hollow beams can be manufactured by this method.

The Septic Tank Patent Question.

Editor of MUNICIPAL ENGINEERING:

Sir—Inclosed please find a copy of a letter sent March 13 to the American Society of Civil Engineers, which explains itself. It refers to a question which merits serious attention at the present time from all sources.

ALEXANDER POTTER, C. E.,
New York City.

THE AMERICAN SOCIETY OF CIVIL ENGINEERS:

Gentlemen—Last week the writer had forwarded to him a circular letter from a municipality in which he had constructed a septic tank, which circular letter, written by a member of this society, requested the municipality referred to to contribute $100 now, with a prospect of contributing an additional $200 at a later time, to carry the fight against the patentees of the septic tank to the Supreme Court of the United States. This municipality requested an opinion from me as to their course in the matter, which I was not able to give.

Another town receiving a somewhat similar letter asked the writer why he had constructed their system without having the royalty claims arranged. This question also I was not able to answer in a satisfactory manner, any more than most of the engineers throughout the country could answer it.

In still another city, on the eve of an election, an engineer addressed a letter to the public advising the people to defeat the sewer proposition. One of his chief grounds for such advice was that the municipality "would be in no very good situation to make favorable terms with the patentee if the plans had been previously adopted" by the people at the polls.

The writer holds no brief for the Cameron Septic Tank Company, but he desires to make a plea to the municipal engineers of the country that they put forth the same energy in trying to come to a reasonable agreement with the patentees of the septic tank as some are putting forth in resisting the payment of a debt that we undoubtedly owe to Mr. Donald Cameron, the patentee of this septic tank. It seems to the writer that an agreement could be reached by the engineers that would be fair both to their clients and to the patentee. That they owe something to Mr. Cameron is clearly evidenced by the widespread and general adoption of the septic tank as an integral part of sewage disposal throughout the United States and Canada. As to the cash value of this debt, the writer frankly admits he has not given the matter sufficient attention to reach a conclusion, but does not consider that engineers are warranted in ignoring the obligation.

There is no well-established law, written or unwritten, that makes it a misdemeanor or even unprofessional to patent engineering inventions of general utility. The law of the land recognizes the right of an inventor to a reward for his invention. In most other lines of work patents are considered proper, but when an engineer essays to patent anything useful, he frequently becomes the storm center of an attack from all his fellows. This attitude does not make for advancement along either scientific or practical lines. If an inventor is allowed to enjoy the fruits of his invention it will act as an incentive to others to develop still other improvements, and the whole community is thus benefited; the public have more systems to choose from and monopoly is prevented. In the case of the septic tank, however, most of us will admit that while it is almost an essential part of sewage purification as we now know the art, we have perhaps unwittingly aided in depriving the man who first brought it to our attention of the fruits of his labors. It seems to the writer that a city should not be deprived of the use of methods of such universal application as the septic tank, but that an effort should be made to secure from the Cameron Septic Tank Company some agreement that would not only be just and equitable to the company, but that would give all engineers the right to use the septic tank as a part of their design, without feeling that they may be involving their clients in some unknown and exorbitant fee for royalty.

The writer would therefore suggest that this society take some initiative in this matter and endeavor to reach a conclusion which could be accepted as fair, alike to the Cameron Company, engineers who make such use of this patent, and also to the cities for whom such designs are made. The present attempt to carry this case to the Supreme Court will unquestionably tend to delay public improvements, and in the writer's opinion it is the proper function of this society to effect remedial conditions in such an instance.

Yours very truly,
(Signed) ALEXANDER POTTER.

The writer is unable to see the justice of Mr. Potter's position, although there may be some support of its expediency. As stated in Mr. Metcalf's paper on "The Antecedents of the Septic Tank," pre-

sented to the American Society of Civil Engineers some years ago, and as stated several times in MUNICIPAL ENGINEERING, most recently in an editorial in the February number, vol. xxxiv, p. 94, entitled "Septic Tank Patents Sustained," the writer unconsciously designed a septic tank about the year 1890, which was built shortly afterward, and at last report was still operating with pronounced success.

Professor Talbot made the design for the first Urbana tank soon after, and followed that with the Champaign tank within another year or two, and all of these were in working order when the Cameron patents were issued.

However true may be the statement that Mr. Cameron made the first differentiation of the actions of bacteria in purifying sewage and gave the first full explanation of the principle of the action of the septic tank, it hardly seems possible, under United States patent laws, to patent the full or partial explanation of an action which had been successfully in operation for more than two years prior to the application for patent and which had been described in public prints prior to that period, and which was, in two of the cases at least, partially explained in the designs. So far as the septic tank alone is concerned, therefore, there does not seem to be any real question of the priority of the three tanks named. When it comes to the combination of anaerobic septic tank and aerobic filter, however, the case may be different and the patents thereon may be valid.

Unfortunately, the courts do not always take the same view of a case that those watching their action think should be taken, sometimes because the courts are right, but also sometimes because they are not fully informed, and therefore, sometimes, the decisions of the courts must be accepted, at least temporarily, and courses of action must be made to conform thereto. It may be desirable, therefore, to make some living arrangement with the owners of the patents in question whereby improvements shall not be stopped for fear of suits for damages. The well-known good sense and business ability of the said owners makes such an arrangement more than probable, and so new work can be arranged for with a payment of reasonable royalty, even though the engineers' opinion may be the opposite of that given by the court. The judge lays down the law anad it must be obeyed until annulled by later decisions.

Cities already operating septic tanks alone can settle or defend suits for infringement, as they may prefer, until the later decisions are secured. Perhaps the joint effort proposed by Mr. Potter is the best means of securing uniform results, although each individual city can undoubtedly make quite as reasonable terms under the decision.

Cities operating combinations of septic tanks and filter beds seem, with present information, to be liable for payment of royalties in any event.

Subscription to the committee for carrying on the litigation over the patents may result in earlier final decision. The committee selected at a recent meeting of representatives from city and state administrations for this purpose is composed of leaders in sanitary science and practice, and will inspire confidence in the sincerity of its purposes. It consists of F. Herbert Snow, Chief Engineer, State Department of Health, Pennsylvania, chairman; R. W. Pratt, Chief Engineer, State Board of Health, Ohio, secretary; G. A. Johnson, Consulting Engineer, New York, treasurer; Wade Ellis, Attorney General State of Ohio; T. C. Hatton, Consulting Engineer, Wilmington, Del.; G. E. Hill, Consulting Engineer, New York; R. A. Cairns, City Engineer, Waterbury, Conn.

LIGHT AND POWER

Gasoline and Alcohol for Engine Fuel—Gas Lighting in Hempstead—Tests of Electric Lamps—Hauser Lake Dam—Michigan Law Upheld

Comparison of Gasoline and Alcohol for Internal Combustion Engines.

The technologic branch of the United States Geological Survey, under the direction of Mr. J. A. Holmes, has recently completed an elaborate series of tests on the relative value of gasoline and alcohol as producers of power. The tests, over two thousand in number, probably represent the most complete and exact investigation of the kind that has been made either in this country or abroad, and includes much original research work.

Prof. R. H. Fernald, engineer in charge

of the gas producer section and professor of mechanical engineering in the Case School of Applied Science, Cleveland, O., was in general charge of the tests. R. M. Strong, formerly connected with the engineering department of Columbia University, had personal supervision of the work. He was assisted by a corps of specially trained men.

These tests were conducted at the fuel testing plant of the Geological Survey at Norfolk, Va., and show the following results in regard to the comparative fuel consumption of 73-degree specific gravity gasoline and commercial completely denatured alcohol, per unit of power.

Correspondingly well-designed alcohol and gasoline engines, when running under the most advantageous conditions for each, will consume equal volumes of the fuel for which they are designed. This statement is based on the results of many tests made under the most favorable practical conditions that could be obtained for the size and type of engines and fuel used. An average of the minimum fuel consumption values thus obtained gives a like figure of 0.8 of a pint per hour per brake horse power for gasoline and alcohol.

Considering that the heat value of a gallon of the denatured alcohol is only a little over 0.6 that of a gallon of the gasoline, this result of equal fuel consumption by volume for gasoline and alcohol engines probably represents the best comparative value that can be obtained for alcohol at the present time, as is also indicated by continental practice. Though the possibility of obtaining this condition in practice here has been thoroughly demonstrated at the Government fuel-testing plant, it yet remains with the engine manufacturers to make the "equal fuel consumption by volume" a commercial basis of comparison.

The gasoline engines that were used in these tests are representative of the standard American stationary engine types, rating at 10 to 15 horse power, at speeds of from 250 to 300 revolutions per minute, while the alcohol engines were of similar construction and identical in size with the gasoline engines.

The commercial completely denatured alcohol referred to is 100 parts ethyl alcohol, plus 10 parts methyl alcohol, plus ½ of one part benzol, and corresponds very closely to 94 per cent. by volume or 91 per cent. by weight ethyl alcohol (grain alcohol). No detrimental effects on the cylinder walls and valves of the engines were found from the use of the above denatured alcohol.

The lowest consumption values were obtained with the highest compression that it was found practical to use, which compression for the denatured alcohol ranged from 150 to 180 pounds per square inch above atmosphere.

Eighty per cent. alcohol (alcohol and water) for use in engines of the present types would have to sell for at least 15 per cent. less per gallon than the denatured alcohol in order to compete with it. The minimum consumption values in gallons per hour per brake horse power for 80 per cent. alcohol is approximately 17.5 per cent. greater than for the denatured alcohol used or for gasoline. A series of tests made with alcohol of various percentages by volume ranging from 94 per cent. to 50 per cent. showed that the minimum consumption values in gallons per hour per brake horse power increased a little more rapidly than the alcohol decreased in percentage of pure alcohol. That is, the thermal efficiency decreased with the decrease in percentage of pure alcohol. This decrease in thermal efficiency or increase in consumption referred to pure alcohol, is, however, comparatively slight from 100 per cent. alcohol down to about 80 per cent. alcohol. Within these limits it may be neglected in making the calculations necessary to compare the minimum consumption values for tests with different percentages of alcohol.

The nearer the alcohol is to pure, the greater the maximum horse power of the engine. The per cent. reduction in maximum horse power for 80 per cent. alcohol, as compared with that for denatured alcohol used, was less than 1 per cent., but the starting and regulating difficulties are appreciably increased.

As has been previously published, alcohol can be used with more or less satisfaction in stationary and marine gasoline engines, and these gasoline engines will use from one and one-half to twice as much alcohol as gasoline when operating under the same conditions. The possibilities, howeevr, of altering the ordinary gasoline engine as required to obtain the best economies with alcohol are very limited, for the amount that the compression can be raised without entirely redesigning the cylinder head and valve arrangement is ordinarily not sufficient, nor are the gasoline engines usually built heavy enough to stand the maximum explosive pressures, which often reach six and seven hundred pounds per square inch. With the increase in weight for the same sized engine designed to use alcohol instead of gasoline, comes an increase in maximum horse power of a little over 35 per cent., so that its weight per horse power need not be greater than that of the gasoline engine, and probably will be less.

Gas Street Lighting in Hempstead, N. Y.

The lighting of the streets of Hempstead, N. Y., was formerl yaccomplished by means of seventy 1,200-candle power arcs, and 111 incandescent electric lamps, rated at 32-candle power each, but on May 1st these were replaced by 290 mantle gas lamps. While the candle illumination was nominally reduced from 87,552 to 23,200, the actual efficient illumination is said to have been changed conversely. The gas company owns all of the lamps and fixtures, and does all of the lighting, extinguishing, cleaning, etc., at the contract price of $22.50 per lamp per annum, on a 5-year contract. The services are 1-inch and the standpipes are ¾-inch, the lower end being 1½ inches, as a protection from frost.

The city of Indianapolis is lighting some of its best residence streets, where shade is very heavy, with similar lamps very successfully, but is paying about $30 a year for them, although bids received and rejected a year previous to the letting of the contract were at nearly the same figures that Hempstead is paying.

Tests of Electric Lamps.

Bulletin No. 19 of the Engineering Department of the University of Illinois, "Comparative Tests of Carbon, Metallized Carbon and Tantalum Filament Lamps," by T. H. Amrine, has just been issued.

This bulletin gives a comparative study of the electrical characteristics, life, candle power, maintenance, horizontal and vertical distribution and cost of operation of the three most widely used electric lamps under both good and poor conditions of operation. It is based upon a series of tests in which particular attention was paid to obtain exactly similar conditions for the three types of lamps in order to give a fair basis of comparison between types. Comparative rather than absolute results have been striven for, though, in almost all cases, dependable quantitative values have been obtained. In an attempt to explain the reason for high efficiency of the newer lamps a study is made of curves plotted between "Filament Temperatures" and "Candle-power per square inch of Filament Area" and between "Watts per Candle-power" and "Filament Temperature." A consideration of these curves leads to the conclusion that the increase in efficiency of the metallized over that of the carbon filament is due almost equally to higher filament temperature and to selective radiation, while for the tantalum filament, it is due almost wholly to higher temperatures.

Hauser Lake Dam Swept Away.

About half of the steel and concrete dam of the Helena Power Transmission Company, located at Hauser Lake, 20 miles north of Helena, Mont., was swept away April 14. The dam impounded the waters of the Missouri river a total distance of 22 miles. When it was swept away a wall of water 70 feet high rushed down Beartooth canyon, sweeping everything before it, and while there were many narrow escapes at the dam, no lives were lost, and only one man was injured. Faulty steel construction is the cause assigned for the accident. The Hauser Lake plant was put in operation in February, 1907, and generated 15,000 horse-power, most of which went to Butte and Anaconda. The plant cost $1,200,000. The dam was 70 feet high and 630 feet long, and between 250 and 300 feet of the middle sections were destroyed, the ends and abutments remaining intact.

Michigan Law Upheld.

An opinion was handed down April 20 by Justice Holmes, of the United States Supreme Court, in the case of the United States against the Chandler-Dunbar Water Power Company, affirming the decision of the United States Circuit Court for the Sixth District, whose opinion was favorable to the company. A number of interesting questions were involved in the case, including the treaty rights of Great Britain in St. Mary's river, Michigan, and also the rights of riparian owners to the bed of that stream. The company claimed, through a grant made by the government in 1883 to one Chandler, a tract of land lying along the St. Mary's and opposite islands, known as Nos. 1 and 2, in that stream. The islands are nothing but barren rocks of smooth surface, but, as there is a rapid fall of the stream at this point, a sharp rivalry has developed between two power companies for their possession. The Michigan Lake Superior Company originally began the proceeding in an effort to control the stream, and the government was drawn into the case through that company's allegations that the Chandler company was not in legal possession of the stream. The government brought the suit to "quiet its title." It was contended, on behalf of the government, that the ownership of the mainland did not carry with it title to the bed of the stream and

the islands lying between it and the thread of the stream, and as it was alleged that the assertion of private ownership would not interfere with commerce, but might affect Great Britain's rights, because this is a boundary stream between the United States and Canada, the government sought to obtain a ruling against Chandler's rights on the islands. The Court of Appeals, however, held against the government on all these contentions, and the Supreme Court affirms this decision. The questions as to whether the rights of Great Britain were involved were not discussed by Justice Holmes, but he held that the Michigan law granting the beds of streams with contiguous lands should control in the case. The water rights involved are valuable, and important legislation by Congress has, for some time, been waiting on the decision rendered in the case.

BUILDING MATERIALS

Poured Concrete House—Stopping Leaks in Concrete—Concrete in California—Properties of Sand Lime Brick—Timber Specifications

An English Development from the Poured House.

London *Punch* has the following description of interesting developments of some of the principles which have been assumed as the basis for pouring wet concrete into forms for concrete houses and their appurtenances, with the addition of one or two others not materially more extravagant:

Mr. Edison's announcement, while paralyzing the building trades, has stimulated activity in other quarters.

The more extravagant party in the London County Council talk of laying liquid-cement mains in suburban London. It would be a great boon, they argue, to the ratepayer to be able to turn on the cement, just as nowadays he turns on the water for the garden hose. If unexpected guests come, for whom there is no room in the house, if a fowl house or dog kennel should be required, if the householder has ambitions towards a billiard room, if a porch or conservatory, or even a summer house, should need to be built, if the roof begins to leak in a storm, or (as in some cases it has done) becomes restless, if the garden wall must be raised to keep next-door from staring—in fifty different emergencies a ratepayer would find an ever-ready supply of liquid cement most useful. All he would have to do would be to send down to the local ironmonger for the molds, stick them up, and then leave the tap running into them, with perhaps the youngest boy to keep an eye on it.

We would like to suggest that the cement tap ought to be colored red, so that it be not confused with the water tap. Cement, however liquid, is not a good thing to water the garden with or to boil the potatoes in.

Stopping Leaks in a Concrete Reservoir.

At Ulbridge, Mass., the water department had a concrete reservoir 71 feet in diameter, 19 feet deep and covered, underground, and holds 500,000 gallons when full to the high-water mark. The concrete was mixed by the following formula: one part Portland cement, 2½ parts sand and 4½ parts coarse gravel or broken stone, whose largest diameter should not exceed 2½ inches. The bottom of the reservoir was to be 5½ inches in thickness of this mixture and ½ inch of concrete, 1 to 1. The circular side wall was made of the mixture of cement, and in its construction the use of 40 per cent. of boulders was allowed; this wall is 4 feet thick at the bottom and 2½ feet at the top. The reservoir leaked badly, and, after repeated attempts, the following was successful: Two carloads of the best hard burnt bricks were purchased, which were laid in Portland cement mortar, using forms between the bricks and the cement wall so as to make a uniform space of about ¾ inch, which was poured full of roofing pitch every fourth course of brick. When the wall was completed it was washed with two coats of neat cement. The water was again pumped in, the gates were shut, and the reservoir was found to be water-tight, and it remains so at the present time.

Physical Properties of Sand-Lime Brick.

The following results of tests of sand-lime brick were reported to the National Association of Manufacturers of Sand-Lime Products. They are taken from detailed tables presented by Dr. E. W. Lazell and show the principal results of tests of over 100 sample bricks submitted by some 15 different manufacturers.

The percentage of sand used in making the bricks varied from 55.38 to 91.24 averaging 88.51. Oxide of iron and alumina varied from 0.39 to 2.04 per cent., averaging 1.17 per cent. Lime varied from 4.91 to 18.94 per cent., averaging 6.46. Magnesia averaged 0.53 per cent.

Fineness of mixture averaged 95.5 per cent. through No. 20 sieve, 91 through No. 30, 82.7 through No. 40, 66.2 through No. 50, 51.2 through No. 60, 28.8 through No. 80, and 20.6 per cent. through a No. 100 sieve. The variation on the No. 100 sieve was from 1.7 to 32.5 per cent., and was nearly as great on the No. 80 sieve, reducing as the coarseness of the sieve increased. This variation in fineness did not seem to affect the results for strength.

The pressure used in the hardening cylinder varied from 115 to 130 pounds for the various manufacturers, averaging 122 pounds; the time in the cylinder varied from 8 to 14 hours, averaging 10 hours.

The absorption of water by the bricks varied from 10.16 to 21.69 per cent., on individual bricks or from 12.09 to 21.68 in the average of the various lots of brick, the general average being 15.16 per cent. The New York City specification requires an average not exceeding 15 per cent. and no result over 20 per cent. Half the lots shown in the table would pass this requirement and 5 of the other 8 exceed the 15 per cent. average by less than 1 per cent.

The modulus of rupture varies in individual cases from 227 to 846 pounds, in averages of the samples of each factory from 306 to 612 pounds, and the general average is 446 pounds. The New York specification requires 450 pounds average with no result below 350. Seven of the sets of samples are above the limit and nine are below.

Under compression the strength varies from 1864, to 5402 pounds per square inch, for individual bricks, from 2216 to 4278 pounds for sets of samples with a general average of 2922 pounds per square inch. The New York specifications requires an average of 3000 pounds per square inch with no result less than 2500 pounds. Only 3 sets of samples comply fully with the requirements, although 6 or 7 are very close.

The saturation of the bricks for the absorption tests reduces the strength an average of 1961 pounds per square inch, a loss of 32.88 per cent. The New York specification requires that the loss of strength when saturated shall not be more than one-third. Eight sets of samples meet the requirement and eight do not.

These results with sand-lime brick compare well with those on common brick according to the author of the paper.

One interesting series of tests was made on the two halves of bricks to show the effect of filling the brick molds in the manufacturing process upon the strength of the brick. The transverse test was made on a lot of bricks made on the vertical press with an average result of 596 pounds. The two halves of the bricks were then crushed with the result that the average of the front halves of the bricks was 3443 pounds per square inch and of the other halves 3759 pounds. Another series gave 3161 and 3527 pounds respectively, for compressive strength, the modulus of rupture being 712 pounds. The same test was made with bricks made in a rotary press and gave a modulus of rupture of 768 pounds, a compressive strength of 4266 pounds per square inch for the outside halves and of 4514 pounds for the inside half. Ten bricks were used—each of the three sets of tests. It is evident that much variation in tests of compressive strength can be made in the machine.

Applications of Concrete in California.

The accompanying photographs have been sent by F. Montigel & Sons, of Redlands, Cal., and show some of their work in that vicinity. The bridge is apparently in a park and fits itself well into its surroundings, although there is some roughness about the joints between blocks.

The second photograph shows a concrete irrigating flume fed from the box in the foreground, the height of the weir being adjustable by planks in the grooves, one of which is shown. The flume is 12 inches wide and 12 inches deep inside, and is 406 feet long.

Nomenclature and Specifications for Structural Timber.

The Committee on Standard Specifications for the Grading of Structural Timber reported at the recent meeting of the American Society for Testing Materials its final conclusions regarding certain portions of its work, as follows:

Standard Defects. — Measurements which refer to the diameter of knots or holes should be considered as referring to the mean or average diameter.

A CONCRETE IRRIGATION FLUME NEAR REDLANDS, CAL.

A CONCRETE BRIDGE AT REDLANDS, CAL.

1. Sound Knot.—A sound knot is one which is solid across its face and which is as hard as the wood surrounding it; it may be either red or black, and is so fixed by growth or position that it will retain its place in the piece.

2. Loose Knot.—A loose knot is one not firmly held in place by growth or position.

3. Pith Knot.—A pith knot is a sound knot with a pith hole not more than ¼ in. in diameter in the center.

4. Encased Knot.—An encased knot is one which is surrounded wholly or in part by bark or pitch. Where the encasement is less than 1-8 in. in with on both sides, not exceeding one-half the circumference of the knot it shall be considered a sound knot.

5. Rotten Knot.—A rotten knot is one not as hard as the wood it is in.

6. Pin Knot.—A pin knot is a sound knot over ½ in. in diameter.

7. Standard Knot.—A standard knot is a sound knot not over 1½ in. in diameter.

8. Large Knot.—A large knot is a sound knot more than 1½ in. diameter.

9. Round Knot.—A round knot is one which is oval or circular in form.

10. Spike Knot.—A spike knot is one sawed in a lengthwise direction; the mean or average width shall be considered in measuring these knots.

11. Pitch Pockets.—Pitch pockets are openings between the grain of the wood containing more or less pitch or bark. These shall be classified as small, standard and large pitch pockets. A small pitch pocket is one not over 1-8 in. wide. A standard pitch pocket is one not over 3-8 in. wide, or 3 in. in length. A large pitch pocket is one over 3-8 in. wide, or over 3 in. in length.

12. Pitch Streak.—A pitch streak is a well-defined accumulation of pitch at one point in the piece. When not sufficient to develop a well-defined streak, or where the fibre between grains, that is, the coarse-grained fibre, usually termed "spring wood," is not saturated with pitch, it shall not be considered a defect.

13. Wane.—Wane is bark, or the lack of wood from any cause, on edges of timbers.

14. Shakes.—Shakes are splits or checks in timbers which usually cause a separation of the wood between annual rings.

15. Rot, Dote and Red Heart.—Any form of decay which may be evident either as a dark red discoloration not found in the sound wood, or the presence of white or red rotten spots, shall be considered as a defect.

16. Ring Shake.—An opening between the annual rings.

17. Through Shake. — A shake which extends between two faces of a timber.

—Names for Structural Timbers.—

Southern Yellow Pine.—Under this heading two classes of timber are used: (a) longleaf pine, (b) shortleaf pine. It is understood that these two terms are descriptive of quality, rather than of botanical species. Thus shortleaf pine would cover such species as are now known as North Carolina pine, loblolly pine and shortleaf pine. Longleaf pine is descriptive of quality, and if Cuban, shortleaf or loblolly pine is grown under such conditions that it produces a large percentage of hard Summer wood, so as to be equivalent to the wood produced by the true longleaf, it would be covered by the term "longleaf pine."

2. Douglas Fir.—The term "Douglas fir" to cover the timber known likewise as yellow fir, red fir, Western fir, Oregon or Puget Sound fir or pine, Northwest and West coast fir.

3. Norway Pine, to cover what is also known as red pine.

4. Hemlock, to cover Southern or Eastern hemlock; that is, hemlock from all States east of and including Minnesota.

5. Western Hemlock, to cover hemlock from the Pacific coast.

6. Spruce, to cover Eastern spruce; that is, the spruce timber coming from points east of Minnesota.

9. Idaho White Pine, the variety of white pine from Western Montana, Northern Idaho and Eastern Washington.

10. Western Pine, to cover the timber sold as white pine coming from Arizona, California, New Mexico, Colorado, Oregon and Washington. This is the timber sometimes known as Western Yellow Pine, or Ponderosa Pine, or California White Pine, or Western White Pine.

11. Western Larch, to cover the species of larch or tamarack from the Rocky Mountain and Pacific coast regions.

12. Tamarack, to cover the timber known as Tamarack, or Eastern Tamarack, from States east of and including Minnesota.

13. Redwood, to include the California wood usually known by that name.

—Standard Specifications for Bridge and Trestle Timbers.—

To be applied to solid members and not to composite members. Except as noted, all timber shall be cut from sound trees and sawed standard size; close-grained and solid; free from defects such as injurious ring shakes and crooked grain; unsound knots; knots in groups; decay; large pitch pockets, or other defects that will materially impair its strength.

Standard Size of Sawed Timbers.—Rough timbers when sawed to standard size, shall mean that they shall not be over ¼-in. scant from actual size specified. For instance, a 12-in. by 12-in. shall measure not less than 11¾ by 11¾ inches.

Standard Dressing of Sawed Timbers.—Standard dressing means that not more than ¼-in. shall be allowed for dressing each surface. For instance, a 12-in. by 12-in. shall, after dressing four sides, not measure less than 11½ in. by 11½ in.

—Stringers.—

No. 1. Longleaf Yellow Pine and Douglas Fir.—Shall show not less than 80 per cent. of heart on each of the four sides, measured across the sides anywhere in the length of the piece; loose knots, or knots greater than 1½ in. in diameter, will not be permitted at points within 4 in. of the edges of the piece.

No. 2. Longleaf Yellow Pine, Shortleaf Pine, Douglas Fir and Western Hemlock.—Shall be square-edged, except it may have 1 in. wane on one corner. Knots must not exceed in their largest diameter ¼ the width of the face of the stick in which they occur. Ring shakes extending not over 1-8 of the length of the piece are admissible.

—Caps and Sills.—

No. 1. Longleaf Yellow Pine and Douglas Fir.—Shall show 85 per cent. heart on each of the four sides, measured across the sides anywhere in the length of the piece; to be free from knots over 2½ in. in diameter; knots must not be in groups.

No. 2. Longleaf and Shortleaf Yellow Pine, Douglas Fir and Western Hemlock.—Shall be square-edged, except it may have 1 in. wane on one corner, or ½ in. wane on two corners. Knots must not exceed in their largest diameter ¼ the width of the face of the stick in which they occur. Ring shakes extending not over 1-8 the length of the piece are admissible.

—Posts.—

No. 1. Longleaf Yellow Pine and Douglas Fir.—Shall show not less than 75 per cent. heart, measured across the face anywhere on the length of the piece; to be free from knots over 2½ in. in diameter, and not be in groups.

No. 2. Longleaf and Shortleaf Yellow Pine, Douglas Fir and Western Hemlock.—Shall be square-edged, except it may have 1 in. wane on one corner, or ½ in. wane on two corners. Knots must not exceed, in their largest diameter, ¼ the width of the face of the stick in which they occur. Ring shakes shall not extend over 1-8 of the length of the piece.

—Longitudinal Struts or Girts.—

No. 1. Longleaf Yellow Pine and Douglas Fir.—Shall show one face all heart; the other face and two sides shall show not less than 85 per cent. heart, measured across the face or side anywhere in the piece; to be free from knots 1½ in. in diameter and over.

No. 2. Longleaf and Shortleaf Yellow Pine, Douglas Fir and Western Hemlock.—Shall be square-edged and sound; to be free from knots 1½ in. in diameter and over.

—Longitudinal X-Braces, Sash Braces and Sway Braces.—

No. 1. Longleaf Yellow Pine and Douglas Fir.—Shall show not less than 80 per cent. heart on two faces and four square edges; to be free from knots over 1½ in. in diameter.

No. 2. Longleaf and Shortleaf Yellow Pine, Douglass Fir and Western Hemlock.—Shall be square-edged and sound; to be free from knots 2½ in. in diameter and over.

PUBLIC IMPROVEMENTS

Board of Arbitration Allowed—Improvements in Galveston—Plan Formulated to Relieve Cities—Municipal Government Favored

Board of Arbitration Allowed.

The Supreme Court of South Carolina rendered a decision March 30 in a case in which the right of a citizen to submit to arbitration a claim against a city for alleged damage to property was involved. The decision was rendered in the case of Thomas T. Earle, of Greenville, S. C., who claimed damages amounting to $1,000 because of changes made in the pavement upon which some of his property fronted. The city of Greenville asked for a restraining order to prevent the board of arbitration on the ground that the original plans for the street had not been altered, and that it was on petition of the property owners on that street that the improvements were made. The case was ordered to a master to take testimony, and on his finding recommendations were

made that the board of arbitration be allowed. The Supreme Court, on the appeal of the city of Greenville, affirmed the judgment of the lower court, and the arbitration will proceed.

Street Improvements in Galveston.

The city of Galveston, Texas, expended, during the last fiscal year, $126,912.26 for street improvements and maintenance. This work included vitrified brick pavement, at a cost of $16,110.85; crushed rock, mud shell and graveling surfacing, $38,590.55; vitrified and concrete drains, $5,917.84; concrete curbing, $587.55; wooden drains, grading and sand filling, $32,099.32; routine work and maintenance, $33,606.85.

Plan Formulated to Relieve Cities.

A bill will be presented to the Illinois Legislature, when it meets, May 5, designed to permit an increase in the bonded indebtedness of Chicago and other Illinois cities, thereby making possible much needed public works. The bill will change the present assessed valuation of property from one-fifth to one-third of the actual valuation. It will also change the tax limitation in the Juul law from 5 to 3 per cent., in order to keep taxes where they are now.

Municipal Government Favored.

The Commission on Municipal Government, appointed by Edward C. Stokes, when he was Governor of New Jersey, submitted its report to the legislature April 10. The commission is composed of Howard K. Stokes, Joseph L. Munn and F. W. Gnichtel. The report says:

"In the reports received from the municipal officials there was no topic upon which so unanimous an opinion was expressed as upon that of the limitation of local debts. The commission discussed the subject briefly in its last report. There is to-day a mass of legislation on the statute books on this subject and this mass is constantly increasing year by year; and the legislature shows no disposition to limit the number of laws on this subject.

"It is a generally recognized fact that it is within the province of each locality to determine its own needs and to provide payment for them. In other words, while theoretically, the State legislature retains its full control over all the petty debts of municipal affairs, in practice it grants freely all that is asked. Under these conditions and bearing in mind the present strong trend of economic thought toward local autonomy, your commission believes that the time has come when a statute should be seriously considered which will recognize in the domain of local government the principles of home rule in certain important fiscal matters. The proposed law, herewith submitted, defines and limits municipalities, giving the widest possible discretion within those limits. Power is granted to them to incur debt for any lawful permanent public improvement. The net debt limit is fixed at two per cent. for counties, seven per cent. for cities and ten per cent. for smaller municipalities."

"The second law proposed (that creating a department of State supervision of municipal accounting and auditing), needs but little comment. The system of municipal accounting in this State can be made uniform and should be made so. A department similar to the one herewith proposed has been in operation in Massachusetts for many years. Judging from the experience of other States which have inaugurated a similar department, this should grow to be one of the most important in the State. The States of Wyoming and Ohio have reaped great benefit from similar laws. These States are away ahead of New Jersey in the proper tabulation of municipal statistics which have proved a great benefit to the cities and the commonwealth at large.

"The final report of the commission will contain a proposed municipal code, a proposed law governing the procedure in all cases of assessments for benefits and awards for damages in connection with public improvements."

ORGANIZATIONS AND INDIVIDUALS

Technical Associations—Municipal Contractors in Middle States—John Wharton Maxcy—William D. Marks

Technical Meetings.

The thirty-first annual convention of the National Electric Light Association will be held May 19, 20, 21 and 22, at the Auditorium Hotel, in Chicago. H. E. Niess, chairman electric committee, 139 Adams st., Chicago.

At the regular meeting of the Des Moines Engineers' Club, April 3, at Des Moines, Ia., James Burroughs, of the city engineering department of that city, read a paper on "Creosoted Block Pavement," in which he said that the wood blocks, properly creosoted and laid on an unyield-

ing foundation, would last indefinitely. He gave as his opinion that the best practice is to lay the blocks directly on a bed of mortar, rolling them heavily before the mortar is set. He said that a thickness of more than an inch of sand below is not conducive to long life for the pavement.

The twenty-eighth annual convention of the American Water Works Association will be held at Washington, D. C., May 11, 12, 13, 14, 15 and 16. Among those who have contributed or promised to contribute papers are the following: William R. Conard, on "Cast Iron Pipe Inspection;" Nicholas S. Hill, "Testing of Meters;" R. J. Thomas, "Detector Meters;" Francis F. Longley, "Historical Sketch of the Washington Water Works;" Dr. W. P. Mason, subject not announced; James M. Caird, subject not announced; Wilson F. Monfort, "Action of Water on Galvanized Iron;" Myron L. Fuller, U. S. Geological Survey, "The Artesian Waters of the Atlantic Costal Plain;" F. A. Barbour, "Results of Test of Gas Producer Pumping Plant at St. Stephens, N. B.;" N. H. Darton, U. S. Geological Survey, "Geological Basis for Artesian Predictions;" J. T. Sawyer, "The Troubles of the Private Water Company;" C. W. Wiles, "Ownership of Public Utilities;" A. W. Cudeback, "Repairing 72-in. Steel Pipe Under Water;" J. N. Chester, "High vs. Low Duty Pumping Engines from the Operator's Standpoint;" George H. Felix, subject not announced; Arthur S. Tutle, "The Premier Meter;" George F. Whitney, "Necessity of Laying Water Mains with the View of Future Cleaning." A number of "experience papers" have also been received and promised, and the committees on standard specifications for cast iron water pipe and uniform annual reports will make full reports. J. M. Diven, sec'y, 14 George st., Charleston, S. C.

The annual convention of the American Society of Civil Engineers will be held at Denver, Colo., June 23, 24, 25 and 26. C. W. Hunt, sec'y, 220 W. 57th st., New York City.

The annual meeting of the American Society for Testing Materials will be held June 23, 24, 25, 26 and 27, at Atlantic City, N. J. Edgar Marburg, University of Pennsylvania, Philadelphia, sec'y.

The annual convention of the American Institute of Electrical Engineers will be held June 29, 30, July 1 and 2, at Atlantic City, N. J. Ralph W. Pope, sec'y, 33 W. 39th st., New York City.

Municipal Contractors in Middle States Form State Associations.

Contractors interested in municipal works in Indiana, Ohio and Illinois have formed permanent organizations for the purpose of promoting the construction of good roads, streets and sewerage systems. The Indiana Municipal Contractors' Association has for its purpose the promotion of good roads and efficient sewerage systems. The association will hold meetings each year on the second Tuesday in January. The directors of the association are Charles Michael, Grant Forbes, G. W. Palmer, W. R. Hines, Dan Foley, Ewing Shields, C. H. Daniels, W. W. Hatch, W. B. Hutchinson, Lawrence Rook and A. G. Trippier. The firms included in the membership, as organized, are:

Michaels & Minnich, Marion; Foulkes & Forbes Company, Terre Haute; G. W. Palmer & Co., Logansport; Hines & Bowlin, Frankfort; American Construction Company, Indianapolis; the Ewing Shields Company, Seymour; Daniels & Lysh, Anderson; Lawrence Rook, Dunkirk; W. W. Hatch & Son, Goshen; W. B. Hutchinson, Jr., & Co., Michigan City; Trippier & Son, Peru.

The Ohio Association of Contractors has for its purpose the promotion of good roads and streets, and securing many necessary reforms in connection with public work. Wide variance exists at present between specifications and plans in various municipalities and the conditions under which competitive bids are asked. One of the principal objects of the association is to secure more uniform specifications throughout the entire state. As now drawn, many specifications force hardships upon the contractor and extra expense upon the property owners, because of obsolete clauses which the contractors feel can be readily eliminated by organized effort. The Ohio association was formed with the following officers: President, Col. N. B. Abbott, Columbus; vice president, F. H. Kirchner, Cincinnati; secretary and treasurer, George B. McGrath, Cleveland; trustees, James E. Conley, Dayton; Edward Kelly, Portsmouth; William J. Wildes, Akron; Philip Garrigan, Toledo; Oliver Rieley, Cleveland; L. A. Fauver, Elyria; Thomas J. Mulligan, Lima; William M. Graham, Columbus; William H. Adams, Zanesville.

The Illinois Association of Municipal Contractors was formed to secure a change in the present State law regarding the bonds issued by municipalities to pay for contract work. It is claimed that the contractors never know that they will get dollar for dollar when they have completed work, and the bonds they have accepted may have to be disposed of greatly below par. The members of the association assert that this system is an injustice to them, as they seldom get the amount of their bid. A change is desired which will make the bond secure whatever amount it calls for, and that, when they are accepted, they will be paid with that amount.

The officers of this association are: President, John E. Bretz, Springfield; vice presidents, W. H. Hill, East St. Louis, A. F. Franks, Jacksonville, T. W. Keys, La Salle, and A. D. Thompson, Peoria; secretary, A. F. Dunlap, Edwardsville; treasurer, L. W. Thompson, Danville.

Honor Twice Bestowed on Engineer.

To twice receive one of the principal honors bestowed by the American Society of Civil Engineers is a distinction achieved by James D. Schuyler, hydraulic engineer of Los Angeles, California. He is also the first member of the profession to meet with this honor. The "Thomas Fitch Rowland Prize" is given annually to the member or any engineer who contributes the most worthy paper describing in detail accomplished work of construction. Mr. Schuyler, who is the author of a standard work on Dams, has been advised that he has received the 1907 award for his paper entitled "Recent Practice in Hydraulic-Fill Dam Construction," a contribution to science which has created a stir throughout the world. He had previously won the prize for his paper, "The Construction of the Sweetwater Dam."

John Wharton Maxcy.

John Wharton Maxcy, C. E., of Houston, Texas, has had a very active career in Mexico and Texas and has solved many engineering problems, in both design and difficult construction, in the south. After a four years' course at the United States Naval Academy, he returned in 1884 to Texas, his native state, and began the activities of his profession, with the object of devoting his life to the development of this vast empire. He first engaged in surveying and mapping a part of the public domain in the state of Texas and while engaged in this work he gathered together much useful information as to the engineering possibilities of state development in irrigation and drainage. Being strong of mind and body, he pushed his enterprises to success. He believes in perseverance without end and a high standard for his profession, which he regards as a creative science for the good and uplifting of mankind. The development of Texas has been his life work and he is justly proud of the part he has played in turning waste places into waving fields of wealth and growing centers of population.

In 1898 he moved to Houston, Texas, and soon saw the necessity of sewage and water purification. Recognizing his success in sewage purification, the Swift and Armour Companies of Chicago erected a testing laboratory for the purification of their complex and concentrated packing house wastes and placed Mr. Maxcy in charge. After devoting eighteen months to the study of this problem, he solved it in a practical and economical manner and designed a complete bacterial plant, capable of handling 10,000,000 gallons of sewage per day. Some of the difficulties of this problem will be appreciated by the profession when the analysis of the crude sewage shows it to be twenty times as concentrated as the ordinary American city sewage.

JOHN WHARTON MAXCY, C. E.,
HOUSTON, TEX.

During the past eight years, Mr. Maxcy has designed and constructed $9,000,000 of enginering work and has in hand for 1908 work amounting to over $1,000,000, consisting of the Marble Falls Hydro-Electric Development, estimated to cost $350,000; Wharton Irrigation Pumping Plant, with a normal capacity of four hundred million gallons per day, estimated to cost $250,000; Marshall paving, $220,000; water systems, $120,000; sewerage systems, $140,000. He is a thorough organizer and has the faculty of selecting good men and making them produce results, both in the field and in the office.

William D. Marks.

Mr. William D. Marks, of New York, is a civil and mechanical engineer of

note, receiving his degree from Yale College in 1870, and continuing his studies in Europe. After a year in railroad work, Mr. Marks began his service in the lighting field as engineer and accountant for the contractors who were building the Laclede gas works in St. Louis, Mo., and he remained with the gas company until the works were in operation.

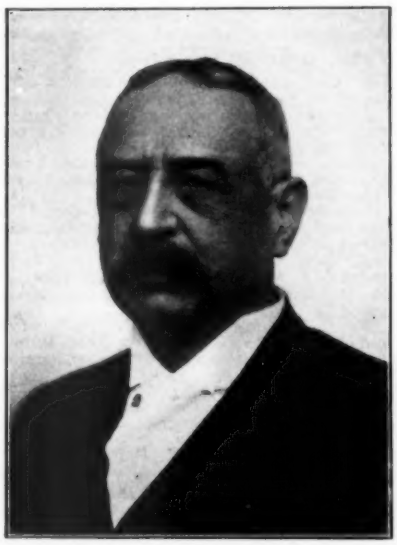
After a period of contracting in the erection of machinery, Mr. Marks entered the educational field in 1876 and retained his connection with it until 1887, being instructor in mechanical engineering at Lehigh University for a year and Whitney professor of dynamical engineering in the University of Pennsylvania for the remainder. During this period Professor Marks interrupted his college work to become superintendent and organizer of the International Electrical Exhibition of the Franklin Institute at Philadelphia.

In 1887 Mr. Marks again entered the lighting field, this time as engineer of the Philadelphia Edison Electric Company, for whom he designed and built the electric light station described in the February number of MUNICIPAL ENGINEERING. In 1892 he was made president of the company, and so remained until the plant was sold in 1896.

Since the latter date Mr. Marks has been engaged in practice as an engineer, and has been connected as manager, director or president with about fifteen gas, electric light and electric railroad companies for which he has constructed new works, operated works and organized finances and accounting departments. For thirty years he has been regularly employed as expert engineer and accountant for the numerous gas works in which the president of the Brooklyn Gas Light Company and his associates were interested, and as investigator of other works and projects for them.

The gas works at Durham, N. C., were constructed and operated for a time by Mr. Marks, and those at Fostoria, O., were reorganized and operated by him.

The results of his studies have been embodied in many scientific papers, and in a work on "Finances of Gas, Electric Light and Power Enterprises," of which a third revised edition has recently been issued. Mr. Marks is an honorary life member of the Franklin Institute of Philadelphia for scientific service rendered, and has been chairman of its executive committee and of its committee on science and the arts. He is a fellow of the American Association for the Advancement of Science and member of the American Philosophical Society, the American Institute of Electrical Engineers, the American Gas Institute, and others, and is in active practice as a consulting engineer and statistician. One of his most prominent recent engagements was as expert on the city's behalf in the case of the Consolidated Gas Company of New York



WM. D. MARKS, PH. B., C. E.,
NEW YORK CITY.

against the State and the city involving the rate to be charged for gas in the city of New York.

Personal Notes.

A. P. Clayton has been elected mayor at St. Joseph, Mo.

Hon. J. C. Schubert was re-elected mayor at Madison, Wis.

Walter F. Abbott has been elected city engineer at Augusta, Me.

Herbert J. Smith has resigned as city engineer at Putnam, Conn.

Hon. Joseph Hahood has been re-elected mayor at Benwood, W. Va.

Earl Lee Tatum, city electrician at Manila, P. I., died March 30.

Carl L. Donaldson has been elected city engineer at Beaver Falls, Pa.

W. A. Gwynn has been appointed city engineer at Key West, Fla.

Arthur W. McArthur has been appointed city engineer at Guelph, Canada.

Maurice F. McKenna has been elected city engineer at Bridgeport, Conn.

F. H. Oldershaw has been re-elected city engineer at New Britain, Conn.

John Marks was elected mayor and John Chine treasurer at Cheboygan, Mich.

Guy C. Emerson has been appointed superintendent of streets at Boston, Mass.

Charles F. Crockett has been elected water commissioner at Somersworth, N. H.

Jacob Stein, of Bessemer, Tenn., has been elected city engineer of Florence, Tenn.

G. Y. Skeels has been elected city engineer, to succeed J. M. Lewis, at Sioux City, Ia.

C. P. Morrison has been elected a member of the board of affairs at Parkersburg, W. Va.

William A. Kimmey, of Wilmington, Del., has been elected city engineer of New Castle, Del.

Edward W. Hooker has been elected mayor, to succeed Ignatius Sullivan, at Hartford, Conn.

Lester A. Pelton, the inventor of the Pelton water-wheel, died recently at Oakland, Cal., aged 78 years.

Charles W. Sherman, M. Am. Soc. C. E., has been elected a member of the water board at Belmont, Mass.

Stephen Tomlinson, superintendent of water-works for more than 30 years at Brantford, Ont., died April 8.

Thomas T. Crittenden was elected mayor April 7 at Kansas City, Mo., to succeed Hon. Henry M. Beardsley.

Robert A. Cummings, M. Am. Soc. C. E., has moved his offices from 4 Smithfield street to 316 Fourth avenue, Pittsburg, Pa.

Edward C. Terry, M. Am. Soc. C. E., hydraulic and mechanical engineer of Hartford, Conn., died April 6, aged 58 years.

A. J. Mathias has been elected mayor, and John MacVicar, Wesley Ash, John L. Hammery and Charles Schramm, councilmen, at Des Moines.

Trimble & Miller, of Pittsburg, Pa., have been appointed borough engineers of Aliquappa, Pa., to prepare plans for borough improvements.

George I. Bailey, M. Am. Soc. C. E., consulting engineer and contractor of New York City, died suddenly of heart trouble March 28 at Yonkers, N. Y.

William D. Murray, Denis Mulvihill, Jr., Walter W. Hubbell and William A. Mackenzie have been appointed assistant city engineers of Bridgeport, Conn.

I. Austin Miller resigned the office of city engineer of Houston, Texas, in July, 1907, to open an office and practice general engineering, at 1015½ Preston avenue.

David S. Rose was elected mayor, April 7, at Milwaukee. This is Mr. Rose's fifth term as mayor, having served for four successive terms before his defeat two years ago.

D. W. Church, assistant engineer in charge of the designing department of the city engineer's office, Chicago, Ill., has been appointed principal assistant engineer of that office.

Frank V. Pellerin, a civil engineer in the employ of Black & Laird, contractors for the water purification plant at New Orleans, was killed recently by falling from a construction dinky on which he was riding.

H. B. Chinnock, who has been in charge of the electrical department of the B. F. Sturtevant Co., of Hyde Park, Mass., will leave that company May 1 and will open an office as contracting electrical engineer at 39 Cortlandt St., New York City.

James Dix Schuyler, M. Am. Soc. C. E., of Los Angeles, Cal., has been appointed a member of an engineering commission to report on an extensive power plant in Japan, which is planned by an English syndicate for operating the street railways of Tokio and Yokohama and for furnishing current for lighting and industrial power in that district.

Harrison P. Eddy, M. Am. Soc. C. E., of Metcalf & Eddy, consulting engineers, 14 Beacon st., Boston, Mass., has declined the position of head of the street cleaning department of Boston. In accordance with a recent city ordinance this department is to be reorganized to combine practically all of the city departments having street work in hand, outside of the water department. The new head of the department will receive a salary of $7,500 a year.

MACHINERY AND TRADE

Concrete Blocks for Prison Buildings.

That Hercules blocks are playing an important part in the construction of many State and public buildings is evidenced by the fact that Hercules concrete block machines are used by the Onondago County Penitentiary at Jamesville, N. Y., the prison camp and hospital of the Massachusetts State Prison at West Rutland, Mass., and the New York City Reformatory at Hart's Island, N. Y. The last named institution has already completed several buildings and one three-story building, to be used as tailor, tin and carpenter shop, is now under course of construction. The first building completed was a small building requiring 560 blocks. This was completed in six working days of six hours each by eight inexperienced boys. The building, while small, is very artistic, being made of panel faced blocks with plain corners. Blocks are being turned out at the rate of 200 every six hours, and as they are giving the highest satisfaction, they will undoubtedly be used generously in the construction of many of the principal buildings. Hercules machines make unusually attractive stone, and are doing much toward advancing the industry.

A Rattler for Paving Brick.

The Portsmouth Machine and Casting Co., of Portsmouth, O., manufactures a rattler barrel which is in use in many paving brick plants throughout the country. It is made according to the specifications adopted by the National Brick Manufac-

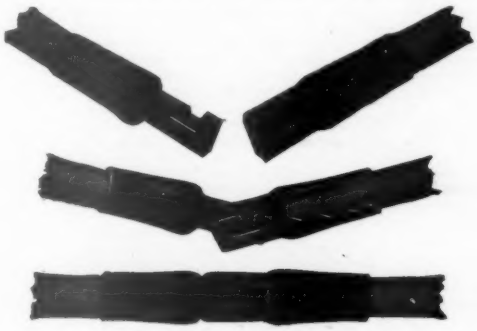
turers' Association. Information and price can be obtained from the above named company.

The Cast Iron Pipe Trade.

Recent prices on cast iron pipe have been made according to the necessities of foundries, and the business has been restricted to small lots under sharp competition, at such low figures as to give no profit to manufacturers. New York quotations are not over $24 a ton, Chicago $29 and Birmingham $27.

Security Sewer Rods.

Since the original appearance of screw joint couplings many designs have been put on the market, and many mechanical devices have been tried, but with little success. Experience develops that the best coupling is the one joined the easiest and quickest, and which holds the rods firmly together without slack and without danger of separation in the pipe, and which is easily uncoupled when removing. The Security sewer rod, which is shown in the



SECURITY SEWER RODS.

illustration, is said to possess all of these advantages, and, in addition, is so simple in its construction that it operates with ease and is not liable to break in the severe handling which sewer rods receive. The hickory rods are driven into iron sockets and spread by iron wedges. The manufacturer claims that wood always breaks at rivet holes, so no rivets are used in these rods unless particularly specified by the purchaser. The rods are made regularly in three and four-foot lengths, but special lengths will be made to order. The F. Bissell Company, Toledo, O., are placing the rods on the market. They also handle a number of other specialties useful to the contractor, which are described in a booklet issued under the attractive title of "A Talk on Negotiable Securities." There is much in the little book of interest to contractors.

The Chicago Quick Dumper.

The Black Manufacturing Co., 126 East Ohio st., Chicago, are sending out a very handsome catalogue, illustrating and describing the Chicago quick dumper. This dumper is so constructed that it can be placed on any regular wagon gear with a reach, and being portable, can be quickly removed when the gear is needed for other purposes. It is equipped with a patented operating device for dumping the contents, and it is said the method of operation is so simple that a boy of ten or twelve years of age can easily handle and operate it, dumping the load without stopping the team, or, if desired, a part of the load can be discharged in one place, the balance in another, or the load may be spread along, if necessary. The dumpers are furnished in any capacity desired, and will handle any material that is practical for dumping. The catalogue is illustrated with some very excellent cuts, showing the method of manufacture and operation of the dumper, and also includes several strong testimonials from well-known companies. Those desiring copy of this interesting catalogue can secure the same by writing the above address for catalogue No. 12.

Paving Brick Men Protest Against Freight Charges.

The National Paving Brick Manufacturers' Association filed a complaint with the Inter-State Commerce Commission, April 27, alleging that freight charges on its products have been increased from 10 to 30 per cent. and that the increase is unreasonable, arbitrary and unlawful. The association asks the commission to determine what is a fair rate on its product.

Trade Publications.

The April bulletin of the Universal Portland Cement Co. has a new title page—one of the popular reproductions of a plaster mold decorated with cement bags and the trade mark of the company. It has the usual photographs of work in which Universal cement has been used.

The Farnham Blue Book, written by Neal Farnham, C. E., is issued by the National Waterproofing and Cleaning Co., 1 Madison ave., New York City, and describes the methods of using paraffine and other waterproofing materials for concrete and other masonry and materials.

The Barrett Company has issued a new booklet devoted to "A New Tarvia Treatment" for making roads dustless.

The Expanded Metal and Corrugated Bar Co., Frisco Building, St. Louis, Mo., have issued their 1908 catalogue, which, in addition to their standard corrugated

squares and flats, shows a new corrugated round bar.

A revolving dryer for sand, stone and similar materials, in which the cylinder is perforated so that the hot air can be drawn into the cylinder through the stone while it is falling through the air, on account of the revolution of the drum, and which, nevertheless, does not leak, is shown by the Atlas Dryer Co., Cleveland, O., in a neatly illustrated booklet. It does the work, and those who are curious to see how can get a copy of the book on application.

An illustrated circular from the Lissen Manufacturing Co., 120 Liberty st., New York, describes their Acme pulverizer machine, which is designed for the purpose of crushing and converting any grade of coal into a floatable powder, delivered to the furnace intimately mixed with the exact requisite of air to complete combustion, theoretically. The fuel in the nature of air is blown into the furnace uniformly, and burns like gas, and it is claimed that a constant and even furnace temperature and perfect combustion can be obtained by the use of the machine.

Trade Notes.

ASPHALT.

Indianapolis, Ind.—The American Paving & Manufacturing Co., of this city, was incorporated April 21, to manufacture paving machinery and appliances, and paving compounds. The pavement is to be manufactured under the Ruffi patents, it is asserted, and will be a bituminous macadam, or better known here as bitulithic. The incorporators are W. J. Mooney, J. G. Mueller, Michael J. Ready, Joseph C. Schaf, Joseph L. Gasper, Robert F. Peele, G. A. Schnull and Herman J. Ruffi.

Grass Valley, Cal.—The board of trustees decided April 10 to purchase an asphalt plant, and the street committee will investigate the matter. Mayor Haas.

Cincinnati, O.—Director Dornette, of the board of public service, and engineer Shipley made a recent trip to Detroit, Toronto, Pittsburg, Buffalo and Cleveland to inspect municipal asphalt plants.

Indianapolis, Ind.—Mayor Bookwalter will, according to reports, appoint Samuel R. Murray superintendent of the city's new asphalt repair plant.

BRICK.

Glouster, O.—Special. The Wassail Clay Company has changed its name to the Wassail Brick Company.

New York City.—The Iron Slag Block Pavement Co. has been incorporated to pave streets and to manufacture material therefor, by Bernard A. Ryan, 271 1st Ave.; Proctor Vail, 758 West End Ave., and George W. Winkleman, 124 E. 127th St.

Crawfordsville, Ind.—The Crawfordsville Shale Brick Co. has been incorporated and will operate the brick plant situated north of this city, formerly known as the Ferguson & Everson Brick Co. All kinds of brick and clay and shale products will be manufactured. The directors of the new company are John T. Ferguson, George B. Luckett, Joseph C. Herron, W. T. Whittington, Charles B. Ferguson, Jas. A. Gilbert and James E. Evans.

CEMENT.

Mitchell, Ind.—The plant of the Mitchell Cement Co. was destroyed by fire March 27, entailing a loss of $15,000. The plant will be rebuilt at once.

Oklahoma City, Ok.—Special. Manufacturers' Agent, Oklahoma City, selling builders' supplies, wants to represent a good brand of cement for southwest trade. It is also open for other builders' supplies. Correspondence solicited. Address L. A. M., care MUNICIPAL ENGINEERING Co., Indianapolis, Ind.

Chicago, Ill. — Special. Meacham & Wright will remove their offices May 1 to 805-810 Corn Exchange Bank Bldg.

Bloomington, Ind.—Special. W. H. Hancock, R. F. D. No. 2, advises us that he desires the address of firms manufacturing cement machinery. He has a tract of 315 acres of land containing shale, limestone and a never-failing supply of water, situated 1¼ miles north of the Indianapolis Southern Railroad, which he thinks would make an ideal site for a cement plant.

Pittsburg, Pa.—Special. H. M. Lavers is interested in a large piece of property containing deposits of limestone and shale suitable for the manufacture of Portland cement. Numerous reports satisfactory to the present owners have been made upon the property, but additional ones are desired by parties in this city who are considering the financing of the project. A man is desired who will visit the property, make a reliable investigation and furnish a trustworthy report. He must be a man familiar with raw material values, competent to pass upon mill plans and specifications and be experienced in the operation of a Portland cement plant.

Kendall, Wash.—The Northwestern Portland Cement Co., of San Francisco, Cal., contemplates the erection of a cement plant here.

New Village, N. J.—The Edison Portland Cement Co. began operating its plant here again April 1, after a shut-down of three months for repairs.

Alpha, N. J.—The Alpha Portland Cement Co. has started up its No. 2 mill here, according to press reports. The Vulcanite Portland Cement Co. issued notice the 1st of April that it would resume operations on full time April 12. The plant had been running with a small force.

Pittsburg, Pa.—Special. The Lehigh Valley Testing Laboratory has moved its offices from 4 Smithfield St. to 316 Fourth Ave.

St. Louis, Mo.—Special.—The sales department of the Iola Portland Cement Company will, on and after April 29, 1908, be located at suite 815 Commerce Bldg., Kansas City, Mo., to which all communications pertaining to the sale or purchase of Iola Portland cement should be mailed. The establishment of a sales department in Kansas City will afford additional facilities for expediting business entrusted to the company, as it then will be in daily communication with the works at Iola by telephone.

CONCRETE BLOCKS.

Kewaunee, Wis.—The government has begun work on the establishment of a concrete block plant here. The blocks will be made under a patent by Major Judson, of Milwaukee, which can be floated into position for harbor work. Blocks will be manufactured for harbor construction work at Manitowoc, Wis. Robert Moser, of Milwaukee, will have charge of the plant.

Green Bay, Wis.—The Concrete Con-

struction Co. has changed its name to the McGrath Construction Co. T. J. McGrath and W. H. Field, the proprietors, have purchased the interest of Chris Vande Sande.

Elmore, Minn.—The Elmore Cement & Tile Co., recently incorporated, has erected a building and will commence at once the manufacture of tile.

Forbes, N. D.—Carl Anderson, of this city, and J. H. Thorden, of Minneapolis, have formed a partnership and will manufacture cement blocks under the firm name of Anderson & Thorden.

Perley, Minn.—C. O. G. Johnson and Jens Lee have formed a partnership as Johnson & Lee, and will manufacture cement and artificial stone.

Decorah, Ia.—Maurice T. Halloran contemplates the purchase of machinery for the manufacture of cement blocks.

Jamestown, N. D.—The H. Forsch & Klandt Co. will erect a plant here for the manufacture of block and cement sidewalks.

Rock Rapids, Ia.—Ed Priester has purchased the Diamond cement sheds and machinery and will manufacture cement blocks.

Armour, S. D.—Humston & Scearce have organized a company for cement work and for the manufacture of cement blocks.

Pillager, Minn.—Ray and Frank Peterson are interested in the erection of a concrete block plant here.

Rapid City, S. D.—Thomas Mair, formerly of Brookings, S. D., will engage in the cement business here.

Wheaton, Minn.—Martin Peterson has begun the manufacture of sidewalk tiles.

Chicago, Ill.—The Pleas Concrete Construction Co. is being organized here for building construction, paving, and dealing in building materials, by Hugo F. Peterson, John B. Synnestvedt and Everett C. Rockwell.

Arcola, Ill.—Special.—P. J. Goggin and Thomas McNally have become associated in business and have erected a concrete plant on the Vandalia Railroad, in this city. The company, under the firm name of Goggin & McNally, are interested in concrete fence posts, building blocks, porch columns, sewer and drain tile, and concrete construction of bridge abutments and arches, cement walk and curbing, drainage and grading work. They are interested in all kinds of machinery and materials to make the business successful.

PROPOSED PURCHASE OF MACHINERY.

New Albany, Ind.—The question of purchasing a street roller has been referred to council.

Cozad, Neb.—Special.—E. J. Hiesrodt desires to purchase the best and cheapest portable concrete mixer with gasoline power.

St. Cloud, Minn.—Ignatz Kraemer, Joseph Engelhard and Joseph Kowalkowski, county commissioners, are investigating road machinery, preparatory to purchasing a road machine.

West Point, N. Y.—Bids are asked until May 6 for a stone crusher plant, steam engine and boiler. Q. M.

Paducah, Ky.—Special.—All Hymveich, N. 7th st., desires addresses of firms making plates and patterns to make concrete blocks.

LIGHT, HEAT AND POWER.

Chicago, Ill.—City council adopted an ordinance recently to legalize a consolidation of the Commonwealth Electric and the Chicago Edison companies, which have a practical monopoly of electric lighting in this city. The measure, which has been pending for two years, extends to the Edison and all subsidiary companies the franchise of the Commonwealth, which has 38 years of life. The new ordinance provides that the city receive a compensation of 3 per cent. on gross receipts.

Pittsburg, Pa.—Special.—The Electric Welding Company has moved its offices from 4 Smithfield St., to 316 Fourth Ave.

Jersey City, N. J.—The Gas Pressure Regulating and Equipment Co. has been incorporated by Louis W. Jacobs, Albert H. Gindole and Peter H. James.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Trenton, N. J.—The city clerk was directed recently to notify the Barber Asphalt Paving Company to repair a large number of streets, in accordance with the provisions of their various contracts.

CONTEMPLATED WORK.

Fremont, Neb.—Paving is proposed for 6th st.

Oskaloosa, Ia.—Brick paving is contemplated for 2nd ave.

Paxton, Ill.—Paxton twp. voted to construct good roads.

St. Cloud, Minn.—Paving is contemplated for St. Germain st.

New Orleans, La.—Paving is contemplated for St. Claude ave.

Saginaw, Mich.—Brick paving is contemplated for Warren ave.

Hancock, Mich.—Voted to issue bonds for street improvements.

Galveston, Tex.—The estimated cost of improving 53rd st. is $10,544.

Davenport, Ia.—Brick paving is contemplated for Esplanade ave.

Hartley, Ia.—The question of paving Main st. is being discussed.

Greensburg, Pa.—Bids will probably be asked soon for paving a number of streets.

Duluth, Minn.—Paving is contemplated for 20th ave., East.

Poughkeepsie, N. Y.—Mayor Sague advocates bitulithic paving for Upper Main st.

Sigourney, Ia.—City council contemplates paving 8 blocks of streets this year.

Madisonville, Ky.—An appropriation of $10,000 is proposed for macadamizing 5 roads.

Watertown, Wis.—The construction of 1 mi. of brick paving is contemplated.

Puyallup, Wash.—The question of paving Meridian st., is again being discussed.

Ft. Wayne, Ind.—Bids will be asked soon for asphalt paving. Frank Randall, cy. engr.

Albany, Ore.—City council has passed a resolution providing for the paving of 1st st.

Memphis, Tenn.—Ordinances have been passed for paving Jackson and other streets with asphalt.

Mellette, S. D.—The question of constructing paving and sewers next season is being agitated.

Luverne, Minn.—City council has authorized the construction of 8,848-sq. ft. of cement sidewalks.

Jersey City, N. J.—The street and water board has decided to repave Hudson st. with wooden blocks.

Newark, N. J.—A resolution has been adopted to repave Broad and Market sts. with some smooth material.

Alliance, O.—The city engineer is preparing plans for paving Columbia st. and grading various other streets.

Camden, N. J.—Council has decided to pave Baird ave. with Belgian blocks and Walnut st. with asphalt.

Sheboygan, Wis.—Street paving and other improvements have been recommended by the board of public works.

Abilene, Kans.—The construction of about 10 blocks of brick paving is contemplated. J. A. Grairs, cy. clk.

Apalachicola, Fla.—This city contemplates the construction of 5-mis. of shell rd. H. W. Morgan, cy. engr.

Springfield, O.—Ordinances have been submitted providing for paving and macadamizing a large number of streets.

Aberdeen, Wash.—City council has ordered improvements on several streets and an 8-ft. sidewalk on Michigan ave.

Moline, Ill.—Bids will be asked soon for constructing 4-mis. of cement sidewalks. Henry G. Paddock, cy. engr.

Knoxville, Tenn.—Bids will be asked soon for paving in improvement districts 19 to 35, inclusive. Cy. engr. Newton.

Marlin, Tex.—City council has under consideration the paving of gutters in the business portion of the city.

Hartford, Conn.—Maps have been received by the State highway commissioner for improving a number of State highways.

Oshkosh, Wis.—Jackson st. will be paved with asphalt, Oakland ave. with tar macadam and Grand ave. with macadam.

Pocomoke City, Md.—The Senate has passed a bill authorizing the issue of bonds for the improvement of streets here.

Decatur, Ala.—This county voted to issue $260,000 bonds for constructing macadamized roads. Wm. E. Skeggs, probate judge.

McKinney, Tex.—The Commercial Club is taking steps to secure paving for the public square and principal business streets.

Muncie, Ind.—Brick paving is contemplated for E. and W. Main sts. A resolution has been passed to pave Wheeling ave. with brick.

Mt. Vernon, Ill.—Plans are being prepared for paving several streets with brick on concrete foundations. S. T. Maxey, cy. engr.

Hagerstown, Md.—This city contemplates paving and widening S. Potomac st. and bids will be received for about 350,000 vitrified paving brick.

Carbondale, Ill.—Plans have been prepared for paving several streets with brick, on concrete base, and granitoid gutters. E. A. Cox, cy. engr.

Sullivan, Ind.—A resolution has been passed to pave S. Main st. and construct concrete sidewalks in both sides of the street and around the public square.

Pendleton, Ore.—A resolution was passed April 8 providing for the paving of 10 blocks of streets with bitulithic or asphalt, and contracts will be let soon for the work.

Chicago, Ill.—Brick paving has been decided upon for Crooked st., from Southport ave. to Clybourn Place, and creosoted wooden blocks for Indiana ave., from 39th to 51st sts.

Indianapolis, Ind.—Bids will be asked for paving Butler ave., in Irvington, from Washington st. to University ave., with bitu-mineral pavement. Mayor Bookwalter.

Macon, Ga.—The Chamber of Commerce has petitioned the county commissioners to macadamize all roads leading out of this city and repair all cross-roads.

Greenville, S. C.—Bids will be asked soon for paving Main st. Jas. A. Morgan, W. E. Beattie, Geo. D. Barr, A. A. Bristow, W. C. Beacham and J. C. Milford, paving comn.

New Orleans, La.—Plans have been completed for repaving the lower side of Esplanade with bitulithic, Calliope with granite blocks and Clio st. with asphalt.

Canton, Miss.—An ordinance has been passed providing for the construction of concrete sidewalks around Court Square and on the street running from Main Square to the Illinois Central depot.

Newport, Ky.—Isabella, Lindsay, German, 9th and 10th sts. will be paved with brick, and cement curb and gutter constructed in Robert, 2nd, Monmouth, Powell and Brighton sts.

Bellingham, Wash.—The cost of paving Dock st. with granite is estimated at $24,633 and concrete curbs at $22,100. Plans and specifications have been approved for paving Madison st.

Pontiac, Mich.—Plans are being prepared for 4,000-sq. yds. of brick paving in Oakland ave. and Water st., and 1,000-ft. of curbing. Bids will probably be asked about June 1. Wm. J. Fisher, cy. engr.

Tullahoma, Tenn.—This city desires to correspond with contractors and engineers for constructing 20,000-ft. of sidewalk, 10,000-sq. yds. of brick paving and 3,700-ft. of concrete curbing. Doak Aydelott, mayor.

Delphos, O.—J. J. Kelly, T. J. Stallkamp and F. H. Laudick have been appointed a committee to employ an engineer to proceed with the preliminary work of paving Main, 2nd, 3rd and 5th sts. with brick.

Colorado Springs, Colo.—The property owners have petitioned council to pave Tejon and Cucharas sts.

Lewiston, Ore.—Council has decided that wood blocks are best adapted to the requirements of this city for paving, and has directed City Engineer Guilland to prepare plans and specifications.

CONTRACTS TO BE LET.

Paulding, O.—Bids are asked until May 8 for macadamizing Wyatt pike. Co. audt.

New Lexington, O.—Bids are asked until May 16 for paving. Chas. A. Beard, cy. clk.

Washington, Pa.—Bids are asked until May 16 for piking 2¼-mis. of roads. Rd. supvrs. Donegal twp.

Le Mars, Ia.—Bids are asked until May

28 for constructing sidewalks on certain strets. V. D. Hoffman, cy. clk.

Ft. Slocum, N. Y.—Bids are asked until June 1 for constructing roads, sidewalks, gutters and drains. Constr. Q. M.

Frankfort, Ind.—Bids are asked until May 16 for constructing 5,360-ft. of gravel road. Charles F. Cromwell, co. audt.

Ashton, S. D.—Sealed bids are asked until May 16 for grading 8-mis. of road in Jefferson twp. O. B. Olson, clk town board.

Springfield, Mo.—Sealed bids are asked until May 5 for brick paving. H. G. Horton, cy. engr.

Britt, Ia.—Bids are asked until May 4 for cement crossing. Jas. E. Verbill, clk.

Chardon, O.—Bids are asked until May 4 for grading and improving a county road. W. W. Hall, co. audt.

St. Louis, Mo.—Bids are asked until May 5 for improving sundry streets. A. J. O'Reilly, prest. B. P. I.

Sigourney, Ia.—Bids are asked until May 6 for brick paving, curbing and gutter work. A. M. Neas, town clk.

Albert Lea, Minn.—Bids are asked until May 11 for constructing cement curb and drain, catchbasins, etc. Coun.

Woodbury, N. J.—Sealed bids are asked until May 5 for 4,165 sq. yds. of bitulithic paving. C. C. Pearson, chmn. st. com.

Youngstown, O.—Sealed bids are asked until May 8 for constructing and repaving stone sidewalks. W. H. McMillen, clk. B. P. S.

Findlay, O.—Sealed bids are asked until May 9 for constructing 5,800 sq. yds. of stone pike in Liberty twp. L. D. Smaltz, chmn. co. comrs.

Davenport, Ia.—Bids are asked until May 5 for constructing brick paving and temporary and permanent sidewalks. Thos. Murray, cy. engr.

Omaha, Neb.—Bids are asked until May 5 for paving with vitrified brick, block, artificial stone and macadam. Dan B. Butler, cy. clk.

Bloomfield, Ind.—Sealed bids are asked until May 5 for constructing gravel and macadamized roads in certain townships. Peter M. Cook, co. audt.

Columbia, Mo.—Bids are asked until May 5 for grading, concrete curbing and brick paving in College ave., Broadway. John S. Bicknell, cy. clk.

Cooperstown, N. D.—Bids are asked until May 4 for constructing cement crossings, curb and gutter. W. H. Carleton, cy. audt.

Shirley, Ind.—Bids are asked until May 12 for constructing 5,936-sq. ft. of cement sidewalks and 2,315-ft. of cement curbing. J. E. Augspurger, clk. town bd.

Paducah, Ky.—Bids are asked until May 12 for 10,320-sq. yds. of asphalt, brick and bitulithic paving, curbing and granitoid sidewalks. L. A. Washington, cy. engr.

Worthington, Minn.—Sealed bids are asked until May 4 (extension of time), for 9,000-cu. yds. of grading. E. C. Pannell, co. audt.

New Brunswick, N. J.—Bids are asked until May 18 for paving 20,000-sq. yds. of Throop ave. with brick. Fred C. Schneider, cy. engr.

Cleveland, O.—Bids are asked until May 6 for constructing a brick roadway in St. Clair road, Euclid twp. Wm. F. Black, clk. co. comrs.

Vincennes, Ind.—Sealed bids are asked until May 5 for constructing 12,710-ft. of gravel roads in Vigo twp. John T. Scott, co. audt.

Versailles, Ind.—Sealed bids are asked until May 5 for constructing macadamized roads in Jackson, Adams and Delaware twps. Nicholas Volz, co. audt.

Paterson, N. J.—Sealed bids are asked until May 6 for repairing and macadamizing a large number of roads in Passaic county. Geo. W. Botbyl, clk. freeholders.

New Lexington, O.—Sealed bids are asked until May 16 for grading, graveling, curbing and paving sundry streets with brick or block. Chas. A. Beard, vil. clk.

Indianapolis, Ind.—Bids are asked until May 5 for paving the north driveway of the State House grounds. O. A. Baker, custodian State House.

Rockville, Ind.—Sealed bids are asked until May 5 for grading, draining and graveling a road in Wabash twp. Samuel Coble, chmn. co. comrs.; H. A. Henderson, co. audt.

Detroit, Mich.—Sealed bids are asked until May 5 for constructing a macadam road on Gratiot road. Edward N. Hines, chmn. co. comrs.; George A. Dingeman, engr.

River Vale (Westwood P. O.), N. J.—Sealed bids are asked until May 7 for macadamizing River Vale, Demarest, Cedar and Piermont aves. George H. Seaman, chmn. twp. com.

Cincinnati, O.—Sealed bids are asked until May 8 for improving Spring Grove ave. from Cincinnati corporation line to Carthage pike, Millcreek twp. Stanley Struble, prest. co. comrs.

Salem, N. J.—Sealed bids are asked until May 9 for constructing macadam roads in Penn's Grove and Dancer's Mill roads, borough of Penn's Grove. J. F. Ayres, dir. freeholders.

Dunkirk, N. Y.—Sealed bids are asked until May 12 for constructing 15,800-sq. yds. of brick paving; also, 2,100-sq. yds. of brick paving at Front and Lake road intersections. L. N. Murray, cy. clk.

Madison Barracks (Sackett's Harbor P. O.), N. Y.—Bids are asked until May 11 for constructing 86,000-ft. of macadam road; resurfacing 14,500-ft. of road; constructing 32,500-ft. of concrete walks.

Fond du Lac, Wis.—Bids are asked until May 7 for constructing cement paving in Forest ave., macadam in Butler st., brick in W. 1st st., and improving several alleys. Bids are asked until May 14 for paving Court st. with brick. B. P. W.

Paducah, Ky.—Bids are asked until May 12 for 10,320-sq. yds. of paving; 2,300-ft. of new granite curb; 1,930-ft. of limestone curb, to be dressed and set; 4,600-ft. granitoid gutters; 33,530-sq. ft. granitoid walks. L. A. Washington, cy. engr.

Gulfport, Miss.—Sealed bids are asked until May 26 for 40,000-sq. yds. of street paving, 15,000-lin. ft. of concrete curb and gutter, and 15,000-lin. ft. of granite curbing. J. W. Thomas, mayor; N. D. Goodwin, cy. clk.; M. F. Sullivan, cy. engr.

CONTRACTS AWARDED.

Zanesville, O.—Bids for paving 9th st. were submitted as follows: Dunzweiler Bros., $9,839; T. M. Lynn, $9,387; Adams Bros., $9,247; H. G. Williams, $9,999; W. S. Gregg, $8,365; J. C. Brown, $9,085; Petit & Abele, $9,004.

Albert Lea, Minn.—Anton Larson was awarded the contract for brick paving here for $1,752.

San Bernardino, Cal.—The contract for paving 3rd st. was awarded to the Fairchild, Gilmore & Wilton Co., for $2,792.

Syracuse, N. Y.—The Warner-Quinlan Asphalt Co., of this city, was awarded the contract for repairing pavements, for $29,160.

Dallas, Tex.—The contract for paving Main st. with bitumen was awarded to the General Supply and Constr. Co., at $1.35 a sq. yd.

Mt. Carmel, Ill.—The contract for paving Market st. with brick was awarded to S. Monave & Sons, of Portsmouth, O., for $13,478.

Chattanooga, Tenn.—The contract for resurfacing McCallie ave. with brick was awarded to the West Construction Co., for $12,023.36.

Racine, Wis.—The contracts for paving Northwestern ave., Wisconsin st. and Hamilton st. were awarded, April 11, to James Cape & Sons.

Noblesville, Ind.—The contract for constructing 28-mis. of gravel roads was awarded to John Halloran, of Indianapolis, for $131,644.35.

San Francisco, Cal.—The Barber Asphalt Paving Co., Rialto Bldg., was awarded the contract for repaving Sutter st., for about $60,000.

Wichita, Kans.—The contract for paving 13 alleys in the business part of this city was awarded, April 14, to H. L. Miles, for $21,565.68.

Mineola, L. I., N. Y.—The contract for paving Glen st. with vitrified brick was awarded to Robert C. Meserole, of Glen Cove, at 55 cts. a sq. yd.

Spokane, Wash.—The contract for paving Sprague ave. was awarded to Henry L. Lilienthal, for Oileroid, for $32,365, and $3,237 for maintenance.

Baltimore, Md.—The contract for paving Fremont ave. with Belgian blocks was awarded to the Maryland Pavement Co., 6 E. Lexington st., for $29,000.

Dallas, Tex.—The contract for repaving Main st., from Austin to Jefferson, with bitulithic, was awarded to the Texas Bitulithic Co., at $1.35 a sq. yd.

Joliet, Ill.—The contract for paving Campbell st. with asphalt was awarded to the Metropolitan Engineering and Construction Co., of Chicago, at $2.10 a sq. yd.

Jacksonville, Fla.—The contract for paving 3-mis. of Turner road, from Moncrief creek to Trout creek, with rock, was awarded to Foster & Long, at 88 cts. a sq. yd.

Minneapolis, Minn.—The contract for furnishing 50,000-sq. yds. of creosoted wood blocks during 1908 was awarded to the Kettle River Quarries Co., at $1.39 a yd.

Washington, D. C.—The contract for grading and paving 1st st., N. E., between H st. and Florida ave., was awarded, April 2, to the Cranford Paving Co., for $13,620.

Belleville, N. J.—The contract for constructing a sidewalk from Little st. to the Nutley line was awarded, April 7, to the Brown & Rusling Co., of New York City, for $4,022.70.

Springfield, Ill.—The contract for repairing asphalt pavements in this city was awarded, April 15, to the Capital City Construction Co., of this city, at $1.85 a sq. yd.

Moline, Ill.—Paving contracts have been awarded as follows: 18th st., McCarthy Improvement Co., $15,461; 3rd st., Tri-City Constr. Co., of Davenport, $15,-850.

Davenport, Ia.—The McCarthy Improvement Co. was awarded the contract for paving 5th st., for $8,093, and the Davenport Constr. Co. the contract for paving 6th st., for $3,558.

Pine Bluff, Ark.—The contract for paving Martin ave. from Olive to State sts. with brick, with asphalt over it, was awarded, April 7, to W. R. Petty & Co., for about $10,000.

St. Joseph, Mo.—Rackliffe & Gibson secured the contract for paving Garfield ave., from 11th st. to the southeastern part of this city, April 3, with Hassam, at $1.85 a sq. yd.

Winchester, Ind.—The contract for paving a number of streets with brick was awarded to Trippeer & Son, of Peru, Ind., at $1.80 a sq. yd. and 57 cts. a lin. ft. for curb and gutter.

Peoria, Ill.—Paving contracts have been awarded as follows: Faraday st., brick, John McAllister, $9,789; N. Chambers ave., brick, Crescent Contracting Co., $6,-086.24; Flora ave., asphalt, Crescent Contracting Co., $5,099.55.

Concord, N. H.—The contract for constructing 4,975-ft. of trap rock pavement in this city and for constructing a macadam road in Pembroke was awarded to Fred W. Ellis, of Melrose, Mass., for $5,-645 and $3,365, respectively.

Indianapolis, Ind.—The Hoosier Asphalt Co. was awarded the contract for paving Meridian st., from Vermont to St. Clair, with asphalt, at $5.71 a ft., and from St. Clair to 16th sts. with creosoted wood blocks, at $5.34½ a ft.

Grand Rapids, Mich.—Paving contracts were awarded, April 16, as follows: Macadam, Morris ave., Klute & Vanderveen, $6,900; brick, S. Division st., Thomas McDermott, $41,893; improving E. Bridge st., Klute & Vanderveen, $32,000.

Huntington, W. Va.—The Luck Construction Co. was awarded the contract for paving 3rd ave. from 24th st. to Guyandotte bridge, for $56,440, and M. F. Leonard secured the contract for paving 3rd ave., from 7th st. to Johnston Lane, with brick, for $33,075.

Seattle, Wash.—Contracts have been awarded as follows: 20th ave., North, grading and constructing concrete sidewalks, John Kalberg, $8,045; Bagley ave., grading, Andrew Peterson & Co., $26,509, and 4th ave., South, filling, C. J. Erickson, $64,000.

Olympia, Wash.—Contracts for road improvements were awarded, April 10, as follows: Ruth & Hartman, of Olympia, State Road No. 8 or Bathis Road, near Oakesdale, Whitman Co., $5,397, and State Road No. 9 or Eskridge Road, near Pullman, Whitman Co., for $5,513; State Road No. 11 or Bigelow Gulch Road, near Spokane, to the commissioners of Spokane Co., for $13,000.

Rock Island, Ill.—The McCarthy Improvement Co., of Davenport, Ia., was awarded the contract for paving 7th ave., from 30th to 38th st., at $1.84¼ a sq. yd. for paving, 40 cts. a cu. yd. for grading, 40 cts. a lin. ft. for straight curb, 60 cts. for curb and gutter, and $80 each for catchbasins, or a total of $36,300.

Ft. Wayne, Ind.—Contracts for constructing sidewalks were awarded, April 13, as follows: Barr st., $1.23, and Lafayette st., 73 cts. a running ft., Moellering Const. Co.; Hanna st., O. F. Menefee, 61 2-5 cts.; Woodland st., 75 4-5 cts. and Packard st., 61 cts., George Wilhelm; Boltz st., $1.52, and Indiana st., 67 1-3 cts., Derheimer & Co.

Saginaw, Mich.—The Cleveland Trinidad Asphalt Paving Co. was awarded the contract for paving S. Washington ave., from Janes to Holland, with asphalt, for $53,338.25, and N. Michigan ave., from Genesee to Bristol sts., with asphalt, for $41,712.65; Russell & Jennison secured the contract for paving Michigan st., from Bristol to Hancock st., with creosoted wood blocks, for $51,179.65. The Cleveland Trinidad Asphalt Paving Co. also secured the contract for paving Burt st., from Genesee to 4th, with asphalt, for $2,010.

Salt Lake City, Utah.—Special.—Bids have been submitted for sidewalk exten-

sion Nos. 127 and 130, and the construction of cross walks during 1908, as follows: No. 127, cement sidewalks, complete grading—J. D. Hanley, $23,497.83; Frank Doran, $30,622.16; J. P. O'Neill Constr. Co., $23,122.87; S. Birch & Sons Cons. Co., $21,872.98; Campbell Bldg. Co., $22,747. No. 130—J. P. O'Neill & Co., $1,924.20; Frank Doran, $2,430.57; J. D. Hanley, $2,126.75; Campbell Bldg. Co., $1,853.30. Constructing cross walks—E. L. Custer, $2,458; A. J. Burt, $2,120; Palm & Nelson, $2,486.

Toledo, O.—The contract for paving Hicks st. with Logan block was awarded, April 16, to Waters Tansey, for $18,577.

Washington, Pa.—Bids were submitted April 16 for constructing roads as follows: (*a*) Laboratory-Lone Pine Rd., 3½ mis.; (*b*) Claysville-Prosperity Rd., 2½ mis.; (*c*) Prosperity-Dunns Station Rd., 2 mis.; (*d*) McDonald-Venice Rd., 1 mi., and (*e*) Washington-Meadowlands Rd., 2 mis.—first figures price on telford and second price on macadam pavement: N. C. Hunter, *a* $41,165 and $41,930, *b* $39,133 and $37,533, *c* $27,915 and $25,140, *d* $16,921 and $16,426, *e* $32,022 and $29,512; Nelson Meredyth Co., *a* $38,086 and $40,777, *b* $24,330 and $25,560, *c* $21,230 and $21,946, *e* $23,490 and $25,070; Hastings & Piper, *a* $47,350 and $44,075; Advance Sand Co., *a* $40,128 and $39,365, *b* $28,980 and $31,000, *d* $15,595 and $15,560, *e* $25,845 and $27,605; Hallam Const. Co., *a* $43,544 and $44,250, *b* $29,085 and $28,585, *c* $25,432 and $25,690, *e* $24,358 and $24,092; L. J. Moore, $23,862 and $22,689, and G. F. Eagan, *c* $26,165 and $26,795.

SEWERS.

Uplands, Pa.—The State department of health has required this borough to devise means to stop pollution of Chester creek and the Delaware river.

CONTEMPLATED WORK.

Hubbard, O.—A sewerage system is contemplated.

Newport, Ark.—A sewerage system is contemplated.

Ventnor City, N. J.—A sewerage system is proposed.

Eau Claire, Mich.—A sewerage system is contemplated.

East Point, Ga.—Plans are being prepared for a sewerage system.

Covington, La.—Plans have been prepared for a sewerage system.

Chickasha, Okla.—Voted to issue bonds for building storm sewers.

Vienna, Ga.—The construction of a sewerage system is contemplated.

Waseca, Minn.—Voted to issue bonds for constructing a sewerage system.

Gas City, Ind.—Plans are being prepared for constructing a sewerage system.

Ashtabula, O.—A resolution has been passed for building a sewer in Lake st.

Hoopeston, Ill.—Plans are being prepared for constructing a sewerage system.

Hereford, Tex.—Voted to issue bonds for constructing sewers.

Newport, Ark.—The establishment of a sewerage system is under consideration.

Warren, R. I.—The question of constructing a sewerage system is being considered.

Brazil, Ind.—Council has approved plans and specifications for Pogue's run sewer.

Lamoure, N. D.—The question of constructing a sewerage system is being agitated.

Janesville, Wis.—Plans are being prepared for constructing a sewer on the East Side.

Mexia, Tex.—The question of constructing a sewerage system is under consideration.

Atchison, Kans.—A resolution has been adopted for building sewers in sewer district Z.

Sandwich, Ont.—Plans are being prepared for constructing sewers in the business section.

Ashfield, Mass.—The question of constructing a sewerage system is under consideration.

Joplin, Mo.—Plans have been prepared for a brick storm and sanitary sewer. J. B. Hodgdon, cy. engr.

Mahnomen, Minn.—The citizens are considering the question of constructing a sewerage system.

Moundsville, W. Va.—Estimates are being made on the proposed sewerage system. Mayor Williamson.

Dayton, O.—This city contemplates the construction of storm water sewers at a cost of $90,000.

Sedalia, Mo.—This city contemplates the construction of a vitrified pipe sewer. Chas. Baker, cy. clk.

Rio Vista, Cal.—The estimated cost of the proposed sewerage system is $12,000. F. J. Kalber, cy. clk.

Birmingham, Ala.—Will vote May 4 on the issue of bonds for extending the sewerage system. Mayor Ward.

Dickson, Pa.—An ordinance has been passed for constructing a system of sewers. Michael Popack, burgess.

Columbus, Ind.—Bids will be asked soon for constructing 15,000-ft. of pipe sewer. L. F. Orr, cy. clk.

Rhinelander, Wis.—The construction of tile sewers in sundry streets is contemplated. Gust. Swedberg, cy. clk.

Dayton, Ky.—Cy. engr. Lindsay has been directed to prepare plans and specifications for three trunk sewers.

Shelton, Wash.—Plans and specifications for a sewerage system 5-mis. long will be prepared by J. B. Weddell, of Olympia.

Delaware, O.—The State Board of Health has approved plans for changing and enlarging the sewage purification works.

Litchfield, Ill.—About $50,000 will be expended in the construction of new brick sewers. C. R. Davis, cy. clk.

St. Charles, Ill.—The construction of sewers in E. and W. Main st. sewer dist. is contemplated. L. G. Caldwell, cy. clk.

New Britain, Conn.—Plans are being prepared for constructing 5 or 6-mis. of sewers. Wm. H. Caldwell, ch. engr. sewer dept.

Perth Amboy, N. J.—Plans are being prepared for about 8,000-ft. of 18-in. pipe sewer on Sheridan st. S. J. Mason, cy. engr.

St. Louis, Mo.—Plans are being considered for constructing a 10-ft. sewer in the district adjoining the old fair ground.

Moundsville, W. Va.—Plans and estimates for a sewerage system, to be built this summer, will be prepared by Chas. P. Collins, cons. engr., Phila.

Celina, O.—Will vote May 16 on the issue of $25,000 bonds for constructing a sewerage system. An engineer has not yet been selected. J. M. Winter, vil. clk.

Quincy, Ill.—The construction of 16 blocks of trunk sewer and 15 blocks of pipe sewer is contemplated, and the contract will probably be let in July. Fred L. Hancock, cy. engr.

CONTRACTS TO BE LET.

Saginaw, Mich.—Bids will be received until June 1 for constructing pipe sewers. R. W. Roberts, cy. engr.

Youngstown, O.—Bids are asked until May 8 for constructing a sewer in Dewey st. W. H. McMillin, clk. B. P. S.

Redwood Falls, Minn.—Bids are asked until May 12 for constructing tile and open ditch No. 10. L. P. Larson, co. audt.

Indianapolis, Ind.—Bids are asked until May 15 for constructing a sewer in Morris st. Jos. T. Elliott, chmn. B. P. W.

Canton, O.—Bids are asked until May 1 for constructing sanitary sewers in sundry streets. C. A. Zellers, clk B. P. S.

Minot, N. D.—Sealed bids are asked until May 8 for constructing galvanized iron corrugated metal road culverts. J. W. Fabrick, co. audt.

Oakland, Cal.—Sealed bids are asked until May 6 for constructing an intercepting sewer in 2nd st., with outlets. W. B. Fawcett, secy. B. P. W.

Mt. Kisco, N. Y.—Bids are asked until May 11 for constructing 13-mis. of sewers, including trunk sewers. I. W. Turner, prest. vil. trustees.

New Orleans, La.—Sealed bids are asked until May 15 for constructing sewer and water systems at Ft. St. Philip, La. Arthur Cranston, Capt. Q. M.

Lawrence, Kans.—Bids are asked until May 4 for constructing a main sewer in Bews ave. and a lateral sewer in blk. 56, W. Lawrence. F. D. Brooks, cy. clk.

Buffalo, N. Y.—Sealed bids are asked until May 5 for constructing a 12-in. tile sewer in Edison ave. and 15, 12 and 10-in. tile sewers in Howlett st. F. G. Ward, comr. pub. wks.

New Orleans, La.—Bids are asked until June 30 for furnishing and erecting at the Algiers sewerage Station C, electrical and pumping machinery. George G. Earl, genl. supt.

Cape Girardeau, Mo.—Bids are asked until May 18 for constructing a complete sewerage system in sewer district No. 1, comprising 12-mis. of pipe sewers and appurtenances. C. C. Hawley, cy. engr.

White Plains, N. Y.—Bids are asked until May 4 for enlarging the present settling basin, the movement of pumps and pipes to a new location and the construction of a new shed. Second—Rearrangement of present settling tanks and construction of filter beds. John J. Brown, prest. vil. bd.; Peter Paulding, vil. clk.

Normal City (Muncie P. O.), Ind.—Bids are asked until May 5 for constructing a main outlet sewer of 15, 18, 20 and 24-in. sewer pipe and a 2x3-ft brick sewer. James G. Mendenhall, town clk., 319 N. Dill st., Muncie.

Springfield, Mo.—Sealed bids are asked until May 5 for constructing vitrified pipe sewers, manholes, flush tanks, etc. G. W. Hackney, cy. clk.

Webb City, Mo.—Sealed bids are asked until 5 p. m., May 4, for constructing 1.62-mis. of public sewers and 2.55-mis. of laterals. W. E. Smith, cy. engr.

Gulfport, Miss.—Sealed bids are asked of 24, 20, 18, 15, 12, 10, 8 and 6-in. vitrified pipe sewers, 23 manholes, 36 catchbasins, 10 gutter basins and 2 concrete bulkheads for outfall into Mississippi river. J. W. Thomas, mayor; M. F. Sullivan, cy. engr.

CONTRACTS AWARDED.

Beloit, Wis.—The contract for constructing 2-mis. of storm sewer was awarded to N. Reichert, for $9,823.

Ft. Pierre, S. D.—The contract for constructing a sanitary sewer was awarded to Curran & Marsh, for $4,736.

Holdredge, Neb.—The contract for constructing a sewer was awarded to J. J. Dunnigan, of Shenandoah, Ia.

Menominee, Mich.—The contract for constructing pipe sewers was awarded to N. J. Mulholland & Son, of Kaukauna, Wis.

Superior, Wis.—The contract for constructing sewers in Central Park was awarded to the Anderson & Johnson Co., for $6,473.

Corlett, O.—The contract for constructing sewers was awarded to Prosser & Wonn, of Youngstown, for about $45,000.

Fort Morgan, Colo.—The contract for constructing sewers was awarded to W. W. Cook & Son, of Junction City, Kans., for $56,459.45.

Dover, N. J.—The contract for constructing a storm water sewer in Morris st. was awarded to Fritz & Partridge, for $4,100.

Two Harbors, Minn.—The contract for constructing 2,200-ft. of 8-in. tile sewer was awarded to Pastoret & Luntz, of this city.

Knightstown, Ind.—The contract for constructing 4,310-ft. of sewer was awarded to Ed Payne, of Newcastle, Ind., for $9,055.49.

Villisca, Ia.—The contract for constructing 2,610-ft. of 10-in. and 1,120-ft. of 8-in. sewer was awarded to Smith & Son, of Indianola, Ia.

Guthrie, Okla.—The contract for constructing storm sewers in dists. 1, 2 and 3 was awarded to the Kirby, Mayfield & Shaw Co., for $19,650.

Hartford, Conn.—The contract for constructing a sewer in Park st. was awarded to Henry Spinach, of Waterbury, Conn., for $25,235.35.

Notre Dame De Grace, Que.—The contract for constructing two sections of a sewerage system was awarded to Henault & Hefferman, for $70,000.

Oakland, Cal.—The contract for constructing sewers in Grove, Jones and 26th sts. was awarded to the Contra Costa Constr. Co., for $16,429.

Omaha, Neb.—The contract for constructing a main sewer in Bedford Place was awarded to the Katz Construction Co., April 14, for $10,366.47.

Seattle, Wash.—The contract for constructing the north trunk sewer in the Green Lake dist. was awarded to Grant Smith & Co., for about $936,000.

Canton, Miss.—The contract for constructing a system of house sewers, 7-mis. in length, was awarded to Sullivan & Long, of Bessemer, for $30,498.

Jackson, Tenn.—The contract for constructing a sewerage system was awarded to the J. A. Grimes Engineering Co., of Portsmouth, O., for $12,377.50.

Grand Rapids, Mich.—The contract for constructing a sewer in S. Front st. was awarded, April 9, to Charles J. Carpenter, of this city, for $92,386.

Salt Lake City, Utah.—Special.—Bids for constructing sewer extension No. 198 were submitted as follows: Strange & McGuire, $1,342; J. D. Hanley, $1,097.26.

Hartford, Conn.—This city awarded contracts for furnishing 100,000 sewer brick as follows: 50,000 each to Michael Kane and E. D. Mills, at $8.50 per thousand.

Carterville, Mo.—The contract for constructing 12,000-ft. of vitrified pipe sewer was awarded to the C. W. Watson Construction Co., of St. Louis, for $14,000.

Louisville, Ky.—The contract for constructing the southern outfall sewer was awarded to the American Engineering and Construction Co., of Chicago, Ill., for $215,913.

Columbia, S. C.—George W. Waring

was awarded the contract for constructing a 12-in. sewer on the west side of the city, from Gervais st. to Elmwood ave., for $4,359.01.

Columbia City, Ind.—The contract for constructing a sewer in W. Market st., was awarded. April 13, to Dennis Gallivan, of this city, at 89 cts. a ft., including catchbasins.

Savannah, Ga.—The contract for furnishing 1,500-ft. of 18-in. and 400-ft. of 12-in. sewer pipe, together with Y's, T's, bends, etc., was awarded to the General Building and Supply Co., of Savannah, for $635.50.

Asbury Park, N. J.—The contract for constructing a sewage disposal plant was awarded to the Herr Co., of Philadelphia, for about $20,000. The contract for constructing a sewer in S. Main st. was awarded to John Thompson, of Avon, N. J., for $2,368.80.

Lockport, N. Y.—The city council has decided to award a contract for building a sewer in Wheatfield st., North Tonawanda, in exchange for the right of way through two streets in North Tonawanda for Lockport's water supply line, to the T. A. Gillespie Co., of New York City.

Lancaster, O.—Bids were submitted for constructing 7,265-ft. of concrete sewers, as follows: W. H. Ralston, Mt. Vernon, $46,040; I. W. Hill, Bellefontaine, $49,924; James Whissell, $49,399; Jardine, Brewer & Tomlinson, Chillicothe, $44,052; I. J. Backus Constr. Co., Dayton, $40,676; Paul & Kearshner, Dayton, $39,006; T. C. McCracken & Co., Columbus, $39,005.

St. Marys, Pa.—The contract for constructing a system of sanitary sewers was awarded to M. O'Herron & Co., of Pittsburg, as follows: 18-in. t. c. pipe, 6-ft. to 14-ft. deep, 70 cts. to $1.45, according to depth, and 18-in. c. i. pipe, under 8-ft. deep, $5, in all about 1,026-ft. of 18-in.; 15-in. t. c. pipe, 6 to 14-ft. deep, 74 cts. to $1.94, and 13-in. c. i. pipe, $5, in all about 3,531-ft. of 13-in.; 12-in. t. c. pipe, 6-ft. to 18-ft. deep, 42 cts. to $1.92; 12-in. c. i. pipe, 8-ft. to 12-ft. deep, $2.50, in all about 5,605-ft. 12-in.; 10-in. t. c. pipe, 6-ft. to 12-ft. deep, 42 cts. to 82 cts., and 10-in. c. i. pipe, 8-ft. to 10-ft. deep, $2.50, in all about 6,189-ft. of 10-in.; 8-in. t. c. pipe, 6-ft. to 12-ft. deep, 39 cts. to 70 cts., and 8-in. c. i. pipe, 8-ft. to 12-ft. deep, $2, in all about 40,852-ft. of 8-in. pipe; 184 manholes, each $40; 38 manholes, over 10-ft., per ft. $4; 111 drop manholes, per ft., $2; 38 flush tanks, each $70; 100 cu. yds. concrete, $4.50; timber cradle, per 1,000-ft. $30; extra excav. per cu. yd., $1.50; total, $45,174.

Norwood, Mass.—Contracts for constructing sewers in sections 1 and 2 (all vitrified and c. i. pipe, branches, cement, sulphur and castings to be furnished by the town) have been awarded as follows: Section 1—To Moore & Co., Boston, at the following bid: Earth Excav.—12,500 cu. yds., 8-ft. deep, 95 cts.; 150 cu. yds., 8 to 14-ft., $1.50; 50 cu. yds., 14 to 20-ft., $2. Rock Excav.—4,000 cu. yds., 8-ft. deep, $3.95; 350 cu. yds., 8 to 14-ft., $7; 10 cu. yds., 14 to 20-ft., $14. Laying pipe with cement joints—150 ft. 12-in., 10 cts.; 900 ft. 10-in., 8 cts.; 3,500 ft. 8-in., 7 cts.; 3,000 ft. 6-in., 6 cts. Laying pipe with sulphur joints—800 ft. 12-in., 12 cts.; 2,500 ft. 10-in., 10 cts.; 7,000 ft. 8-in., 9 cts.; 4,000 ft. 6-in., 8 cts. Laying subdrains—2,000 ft. 8-in., 8 cts.; 4,500 ft. 6-in., 7 cts.; 10 cu. yds. rubble masy. in cement, $8; 100 cu. yds. concrete masy. in trench, $7; 175 cu. yds. brick masy., $17; 100 cu. yds. screened gravel, $2.50; 200 lin. ft. spruce piles, $1.50, and 5,000 ft. spruce lumber, $35. Total, $37,353. Section 2—To Chas. G. Craib & Co., of Winthrop, as follows: Earth Excav.—15,000 cu. yds., 8-ft. deep, 55 cts.; 200 cu. yds., 8 to 14-ft., $1; 25 cu. yds., 14 to 20-ft., $2. Rock Excav.—2,500 cu. yds., 8-ft., $4; 500 cu. yds., 8 to 14-ft., $6.50. Pipe laying with cement joints—1,000 ft. 12-in., 15 cts.; 600 ft. 10-in., 12 cts.; 3,000 ft. 8-in., 10 cts.; 1,400 ft. 6-in., 8 cts. Pipe laying with sulphur joints—1,500 ft. 12-in., 20 cts.; 1,500 ft. 10-in., 20 cts.; 8,000 ft. 8-in., 15 cts.; 4,500 ft. 6-in., 15 cts. Sub-drains—2,000 ft. 8-in., 25 cts.; 6,000 ft. 6-in., 25 cts.; 1,625 ft. 12-in. c. i. pipe laying, 30 cts.; 10 cu. yds. rubble masy. in cement, $5; 100 cu. yds. concrete masy. in trench, $4; 170 cu. yds. brick masy., $12; 100 cu. yds. screened gravel, $2; 5,000 ft. spruce lumber, $30.

WATER WORKS.

Washington, Ind.—The property of the City Water Company will be offered for sale, May 18, to justify receiver's certificates. No bid under $85,000 will be considered. The plant has been in the hands of a receiver for three years, and in that time a modern filtration plant has been installed.

CONTEMPLATED WORK.

Hubbard, O.—A water works system is contemplated.

Kiowa, Kans.—A water works system is contemplated.

Wabasso, Minn.—A steel water tower tank is proposed.

Cashton, Wis.—Voted to issue bonds for erecting a pumping station.

Mobridge, S. D.—A water works system will be installed this summer.

Gratiot, Wis.—Voted to construct a water works system.

Okeene, Okla.—Plans for a water works plant are being made.

Dodgeville, Wis.—The extension of water mains is contemplated.

Deary, Idaho.—The installation of a water works system is contemplated.

West Seneca, N. Y.—A municipal water works system is contemplated.

Dresden, O.—This city contemplates the construction of a water works system.

Libby, Mont.—Survey and plans have been completed for constructing water works.

Cottonwood Falls, Kans.—Plans for a water works system are being prepared.

Chestertown, Md.—Council has accepted plans for constructing a water works system.

Franklin, Pa.—This city voted to issue bonds for constructing a water works system.

Charlotte, Ia.—Voted to issue bonds for constructing a water works system.

Bowdoinham, Me.—The advisability of constructing a water works system is being discussed.

Finley, Wash.—The question of establishing a water works system is under consideration.

Ventnor City, N. J.—The question of providing a water supply system is being discussed.

Ossian, Ia.—Will vote May 11 on the question of installing a municipal water works system.

Roswell, N. Mex.—Bids will be received about May 22 for constructing a water works system.

Sparks, Ga.—Plans for a water works system will be prepared by J. B. McCrary & Co., of Atlanta.

East Grand Forks, Minn.—This city

contemplates the construction of a municipal water works system.

Tarentum, Pa.—The question of constructing a municipal water works system will be voted on.

Etna, Cal.—This city will vote on the question of municipal ownership of the water works system.

Pontiac, Mich.—The erection of a cement reservoir is contemplated. Wm. J. Fischer, cy. engr.

Shawnee, Okla.—City council appropriated, April 8, $3,000 for the extension of the water works system.

Athens, Ga.—Voted to issue $75,000 bonds for water works and sewer extensions. J. W. Barnett, cy. engr.

East Syracuse, N. Y.—The question of a pure water supply is being discussed by the board of water commissioners.

Germantown, Ill.—The question of installing water works is being considered by the board of village trustees.

Albany, N. Y.—The board of aldermen authorized, April 20, the expenditure of $700,000 for an improved water supply.

Louisville, Ky.—Plans and specifications have been authorized for establishing a water works system to supply the county buildings.

Fremont, Neb.—City council has decided to purchase stokers for the boilers of the municipal water and light station.

Wilmington, Del.—Plans are being prepared for constructing slow sand filters, and bids will be asked as soon as the bonds have been sold.

Tulsa, Okla.—Will vote, May 25, on the issue of bonds for the purchase, improvement and extension of the plant of the Tulsa Water Co. O. P. Jones, cy. clk.

San Francisco, Cal.—The Lagunitas Water Co., of Marin county, has decided to issue $2,000,000 bonds for constructing a water works plant and distributing system.

Oklahoma City, Okla.—About $50,000 will be expended in making improvements to the municipal water works plant. The capacity of the filtration system and sedimentation basins will be increased.

Dayton, O.—The board of public service has engaged Arthur Geisler to begin, May 1, to investigate the entire water supply and system of this city, with a view to increasing its capacity.

Harrisburg, Pa.—Plans are being made for the Harrisburg Water Co. for a mechanical filtration plant and 3 pumps, 3 or 4 steel tanks lined with concrete, and reinforced filter beds will be required.

Joliet, Ill.—The Merchants' Association has inaugurated a movement for better fire protection in the business district, and City Engineer Stevens will submit plans for a better water works system.

New York City.—Special.—The C. I. F. Company, 11 Broadway, advises us that a part of a plant is to be installed abroad, and prices are desired for export f. o. b. steamer New York, on water works materials, including hydrants, tees, crosses, valves, bends, water pipe, etc.

San Francisco, Cal.—The reports of Marsden Manson, city engineer, H. D. H. Connick, ch. asst. engr., and T. W. Ransom, cons. engr., on the proposed auxiliary water supply, were submitted April 16. They advise the installation of an immense water works system, at a cost of $5,200,000.

Concordia, Kans.—Special.—E. A. D. Parker, cy. engr., says this city voted, April 7, to issue $42,000 bonds for the extension and improvement of the water works system. Plans and specifications will be prepared by Burns & McDonnell, of Kansas City, Mo., and notice of the letting of contracts will be given later.

CONTRACTS TO BE LET.

Cando, N. D.—Bids are asked until May 4 for sinking a well. H. D. Skinner, cy. audt.

Primghar, Ia.—Bids are asked until May 6 for constructing water works. W. H. Downing, cy. clk.

Dike, Ia.—Bids are asked until May 5 for constructing a water works system. Natt Bagley, clk.

Tipton, Ia.—Bids are asked until May 4 for constructing a concrete reservoir. J. E. Bartley, mayor.

Canon City, Colo.—Bids are asked until May 15 for constructing a new water supply system. P. O'Brien, C. E.

Deshler, Neb.—Sealed bids are asked until May 12 for constructing a water works system. W. E. Philby, vil. clk.

Milan, Mich.—Sealed bids are asked until May 4 for constructing a water works system. W. P. Gregory, vil. clk.

White Bear, Minn.—Sealed bids are asked until May 8 for constructing water main extensions. R. J. Bloom, vil. recdr.

Ft. St. Philip, La.—Bids are asked until May 15 for constructing a water system here. Capt. Arthur Cranston, Q. M.

Grafton, Ill.—Bids are asked until June 1 for constructing a water works system. W. S. Merkel, C. E., St. Louis, Mo.

Hildreth, Neb.—Bids are asked until May 15 for constructing water works. M. A. Earl & Co., engrs.-in-ch., Muskogee, Okla.

Wilmington, Del.—Bids are asked until May 4 for the sale of 4 horizontal pumping engines. Howard B. Griffith, cy. engr.

Bloomfield, N. J.—Bids are asked until May 5 for furnishing 5,000-ft. of 4, 6 and 8-in. B. & S. coated water pipe. Wm. L. Johnson, town clk.

St. Paul, Minn.—Sealed bids are asked until May 21 for constructing a steel water tank and trestle at Fort Assiniboine, Mont. J. E. Sawyer, Const. Q. M.

Council Bluffs, Ia.—Bids are asked until May 18 for constructing a water works plant, embracing power plant, settling reservoirs, distributing system and high-pressure reservoir. S. L. Etnyre, cy. engr.

New Orleans, La.—Sealed bids are asked until June 30 for furnishing and erecting generators, motors, turbine, centrifugal and tri-plex pumps, valves, and other appurtenances. George G. Earl, genl. supt.

New York City.—Sealed bids are asked until May 12 for constructing the Walkill pressure tunnel, a tunnel in rock, 14½-ft. in diameter and 4.43-mls. long, with 6 shafts from 350 to 480-ft. in depth, crossing under the valley of the Walkill river in the towns of New Paltz and Gardiner. The engineer's estimates include, also, 112,800-cu. yds. of concrete masonry, 55,000 lbs. of steel for reinforcing concrete, 190,000 bbls. of Portland cement, etc. John A. Bensel, prest. bd. water sup.

CONTRACTS AWARDED.

Sparks, Ga.—The contract for constructing a water works system was awarded to J. B. McCrary & Co., of Atlanta.

Wheeling, W. Va.—The contract for furnishing a new steam condenser for the large pump at the water works was awarded to the Epping-Carpenter Co., of Pittsburg, for $9,562.20.

De Forest, Wis.—The contract for constructing a water works system has been awarded to the National Construction Co., of South Bend, Ind., for $7,630.

Rome, N. Y.—The contract for constructing a gravity filter was awarded to the New York Continental Jewell Filtra-

tion Co., 15 Broad st., New York City, for $3,300.

Springfield, Mass.—The contract for constructing a filtration plant and settling basins for the Little River water system was awarded to the Charles R. Gow Co., of Boston, for $201,525.

Oakland, Cal.—The contract for furnishing and installing pumping machinery for the auxiliary salt water plant at Lake Merritt was awarded to the Doak Gas Engine Co., for $25,000.

Elsinore, Utah.—The contract for furnishing 20,000-ft. of iron water pipe and other supplies has been awarded to the W. A. Williams Plumbing Co., of Provo, Utah.

Meridian, Miss.—Contracts have been awarded as follows: Furnishing 992 tons of pipe and 3,000 lbs. of lead, Dimmick Pipe Co., of Birmingham, $21,338; valves and hydrants, Fairbanks & Co., of New Orleans, $2,702.

Michigan City, Ind.—The Lake Michigan Water Co. has awarded a contract for preparing plans and specifications for the new auxiliary intake to be built into Lake Michigan to John Erickson, of Chicago.

Arcadia, Ga.—Contracts for water main extension have been awarded as follows: Valves and boxes, Fairbanks Co., Atlanta, $308.80; fire hydrants, R. D. Wood & Co., Philadelphia, $247.50; c. i. pipe, U. S. Cast Iron Pipe Co., Chattanooga, $3,127.04.

Rockton, Ill.—Contracts for constructing a water works system have been awarded as follows: Steel tank and tower, Moravia Construction Co.; 900-ft. 6-in. and 1,000-ft. 4-in. pipe, Massillon Iron and Steel Co.; pump and gasoline engine, Fairbanks-Morse Mfg. Co., of Beloit, Wis.

McGraw, N. Y.—The contracts for constructing a water works system have been awarded as follows: Construction, Chas. R. Lewis, of Ilion; standpipe, Petroleum Iron Works, Sharon, Pa.; hydrants, gates and valves, Ludlow Valve Manufacturing Co., Troy; pipe, lead and specials, Charles Millar & Co., Utica; pumps, Root, Neal & Co., Buffalo.

Klamath Falls, Ore.—The contract for constructing 4,300-ft. of wooden flume in connection with the South Branch canal, Klamath irrigation project, Oregon-California, was awarded to Campbell & Huffmann, of this city, for $20,731. The contract for the construction of the South Branch canal, Klamath irrigation project, Oregon-California, was awarded to Maney Bros., of Winnemucca, Nev., for $78,997.

BRIDGES.

Washington, D. C.—A bridge is proposed across the inlet to the tidal reservoir.

Mt. Vernon, Wash.—Bids are asked until May 9 for constructing a steel bridge. Co. comrs.

Pittsburg, Ind.—Bids are asked until May 15 for constructing bridges over Wabash river. Co. comrs.

Arapahoe, Okla.—Sealed bids are asked until May 6 for constructing 2 steel bridges. Robt. F. Scivall, chmn. co. comrs.

Doomston, Pa.—Bids are asked until May 16 for constructing 2 stone arch bridges. A. J. Leonard, clk., R. F. D. No. 2.

Wauseon, O.—Bids are asked until May 8 for constructing sub and superstructure of 4 bridges. J. E. Merrill, co. audt.

Warrensburg, Mo.—Bids are asked until May 5 for constructing 60 or more concrete culverts. David Mohler, co. highway engr.

Joplin, Mo.—Plans are being prepared for constructing 2 steel viaduct approaches over Joplin creek. J. B. Hodgdon, cy. engr.

Michigan City, Ind.—Bids are asked until May 5 for constructing a culvert and 3 bridges in this city. Chas. H. Miller, co. audt.

Ogden, Utah.—Bids are asked until May 11 for constructing a reinforced concrete arch bridge over Ogden river. A. F. Parker, cy. engr.

Washington C. H., O.—Bids are asked until May 8 for constructing the sub and superstructures of 2 bridges. H. D. Chaffin, co. audt.

Machais, Me.—The question of constructing a steel bridge across Middle river, on the site of the old toll bridge, is being agitated.

Chattanooga, Tenn.—The county court has voted an appropriation for the construction of 3 bridges over the Ocoee and Hiawassee rivers.

Middleport, N. Y.—Plans are being prepared for a lift bridge over barge canal, and bids will be asked soon. Frederick K. Skene, state engr.

Parker, Colo.—Bids are asked until May 8 for constructing a reinforced concrete bridge across Tallman creek. T. W. Jaycox, state engr., Denver.

Springfield, Mo.—Plans are being prepared for constructing 2 reinforced concrete bridges at Booneville and Main sts. H. G. Horton, cy. engr.

Magnolia, Miss.—Bids are asked until May 4 for constructing an iron bridge across Little Tangipahoa river, at foot of Bay st. Bd. co. supvrs.

Gladstone, Man.—Bids are asked until May 5 for constructing a bridge with cement concrete piers. P. St. Clair McGregor, secy. treas., box 15.

Gulfport, Miss.—Bids are asked until May 4 for constructing a drawbridge across Tchoutacabouffa river, near Morris Ferry. F. S. Hewes, clk bd. supvrs.

Port Royal, S. C.—Sealed bids are asked until May 11 for constructing a steel bridge at Port Royal Ferry, Whale branch. W. F. Sanders, co. supvr.

Hamilton, O.—Bids are asked until May 12 for the repair of the west abutment of the bridge over Seven Mile creek, south of Collinsville. J. E. Brate, co. audt.

Jefferson, O.—Sealed bids are asked until May 4 for constructing a reinforced concrete culvert in Liberty st., in Geneva. J. C. Rodgers, chmn. co. comrs.

Pikeville, Ky.—Sealed bids are asked until May 18 for constructing the sub and superstructure of a bridge over Big Sandy river. J. P. Power, chmn. co. comrs.

Circleville, O.—Bids are asked until May 4 for constructing substructure for a bridge at Van Meter run; also, for I-beam bridge. N. C. Bohnert, co. audt.

Covington, Ind.—Bids are asked until May 5 for building a bridge in Shawnee twp. and a concrete retaining wall at Covington viaduct bridge. Chas. C. Thompson, chmn. comrs.

Vicksburg, Miss.—Sealed bids are asked until May 7 for constructing a concrete arch or steel bridge near Spout's Spring, on road No. 33. J. D. Laughlin, clk. bd. supvrs.

Savannah, Ga.—Bids are asked until May 14 for constructing a steel highway bridge across Great Ogeechee river, at King's Ferry. G. Reuben Butler, clk. bd. comrs.

West Seneca, N. Y.—Sealed bids are asked until May 6 for constructing a re-

inforced concrete bridge on Union road, over Cazenovia creek. E. H. Cosgrove, clk. town bd.

Ft. Wayne, Ind.—Sealed bids are asked until May 9 for constructing a steel bridge over St. Mary's river, with concrete abutments. Joseph Tonkel, chmn. co. comrs.

Buena Vista, Colo.—Bids are asked until May 6 for constructing a reinforced concrete highway bridge across Arkansas river, at Brown's canyon. T. W. Jaycox, state engr., Denver.

Columbus, Ga.—Bids are asked until May 27 for constructing a reinforced concrete or steel bridge across Chattahoochee river, at Dillingham st. T. L. Gruzard, ch. bridge com.

Baton Rouge, La.—Sealed bids are asked until May 12 for building a wooden bridge across the Comite river, in the 7th ward. F. A. Woods, secy., Police Jury, East Baton Rouge.

Providence, R. I.—Plans have been prepared for constructing a bridge in Branch ave. with concrete abutments and steel girders, and for a bridge across West River st. A. Clapp, cy. engr.

Upper Sandusky, O.—Sealed bids are asked until May 18 for constructing one steel superstructure and repairing stone abutments of bridge over Sandusky river. J. N. Traxler, co. audt.

Twin Bridges, Colo.—Bids are asked until May 13 for constructing a reinforced concrete bridge across South Platte river at Twin Bridges, 11-mls. south of Fair Play. T. W. Jaycox, state engr., Denver.

STREET LIGHTING.

Frankfort, Ky.—An electric light plant is contemplated.

Port Huron, Mich.—Voted in favor of a municipal gas plant.

Kiowa, Kans.—Plans have been prepared for an electric light plant.

Louisville, Ky.—Bids are asked until May 12 for an electric light franchise. B. P. W.

Redkey, Ind.—The question of installing an electric light plant is under consideration.

Lima, O.—Bonds will be issued during the summer for constructing a municipal electric light plant.

Pulaski, Va.—The question of improving the municipal electric light plant is under consideration.

Danville, Ark.—City council has granted a franchise to A. Pace for installing an electric light plant.

Natchez, Miss.—Bids are asked until May 6 for lighting the streets for 5 yrs. Geo. T. Eisele, cy. clk.

Pacific Grove, Cal.—H. E. Hales, S. J. Evans and others are interested in the proposed construction of a gas plant.

Farmington, Mo.—Plans have been prepared for constructing an electric light plant. Carl Thompson, engr.-in-ch.

Juneau, Wis.—Bids are asked until May 18 for constructing an electric light plant for the Dodge county insane asylum. Bldg. com.

Folsom City, Cal.—Bids are asked until May 11 for constructing an electric light plant at Folsom Prison. State bd. prison directors.

Spencer, Ind.—The Reliance Engineering Co., of Cincinnati, will supervise the construction of an electric light and water works plant here.

West Point, N. Y.—Bids are asked until May 11 for installing electric and combination gas and electric light fixtures for the officers' quarters. Q. M.

Tyler, Tex.—Bids are asked until May 20 for installing a conduit and electric wiring system in the U. S. Postoffice. J. Knox Taylor, supv. arch., Washington, D. C.

Binghamton, N. Y.—Bids will be asked early in June on 1, 2 and 3-yr. contracts for lighting the streets with incandescent and arc lights. Clarence M. Slauson, mayor.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Scranton, Pa.—This city has appropriated $20,000 for the construction of a garbage plant.

Newport, R. I.—The contract for disposing of the city garbage was awarded to Albert Kelly, at $1,500 a year.

Westfield, Mass.—The contract for street sprinkling was awarded, April 15, to Reuben W. Humphrey, for $2,100.

Moline, Ill.—The contract for the disposal of the city garbage for 1 yr. was awarded to J. S. Fargo, at $125 a month.

McKeesport, Pa.—The contract for remodeling and repairing the old garbage furnace at 13th ave. was awarded, April 13, to W. K. Herbert, of this city, for $2,900.

Cincinnati, O.—Sealed bids are asked until May 7 for the collection, removal and disposal of garbage, dead animals, etc., for 1 and 5 yrs. Edwin Henderson, cy. clk.

PARKS.

Carey, O.—A new park of 4 acres is proposed.

Jersey City, N. J.—The purchase of land in Bayonne and Greenville, known as Currie's woods, is advocated for a county park.

Chattanooga, Tenn.—Council passed an ordinance, April 20, providing for a bond appropriation to purchase additional land for East Lake Park.

Washington, D. C.—The District Commissioners have asked for $20,000 for maintenance, $5,000 for the improvement of Rosedale playground, and $186,000 for the purchase of new park sites.

FIRE APPARATUS.

Esmond, N. D.—The purchase of fire apparatus is contemplated.

Georgetown, Wash.—The purchase of an automobile fire engine is contemplated.

Little Falls, Minn.—The fire department is in need of additional hose and other apparatus.

Shawnee, Okla.—Council has appropriated a sum of money for furnishing equipment for the fire station.

Kendallville, Ind.—The Gamewell Fire Alarm Telegraph Co., New York City, has established a fire alarm system in this city.